List of
Courses Offered
for Study Abroad
Programme

USM International
Division of Academic &
International Affairs

1. Medium of Instruction

The Medium of Instruction for most of the undergraduate courses is Bahasa Malaysia (Malay Language). There are a selected number of courses conducted entirely in English, and for some courses, the lectures are in Bahasa Malaysia but special tutorials can be given in English, upon request. These courses are made available for Study Abroad students. In addition, the University does offer study packages taught in English, i.e. the Southeast Asian Studies Package and the Tropical Environmental Studies Package.

2. Units

Courses are weighted in terms of units. The units indicate the contact hours.
For theory courses: 1 unit is equivalent to 1 hour of lecture/tutorial/reading per week for 14 weeks.
For laboratory/studio classes: 1 unit is equivalent to 1 hour of laboratory or studio work per week for 14 weeks.

3. Level of Courses

For all programmes, except Medicine and Pharmacy, the courses are divided into 3 levels, i.e. 100, 200, and 300. Level 100 is for first year or introductory courses. Level 200 is for second year courses and level 300 is for final year courses. Students who are at a higher level are allowed to register for courses at the lower level but not vice-versa. The first digit in the course code, e.g. "BOI 104/4-Cell Biology and Genetics" determines the level of courses; the number 1 as in the example indicates that the courses is of level 100 and the digit that comes after "/" determines the unit.

4. Course Load

The course load for a full time student is between 18-21 units. Every student is required to register for a minimum of 12 units in order to be considered as a full time student.

5. Prerequisites

Some of the courses have pre-requisites and each school will indicate the pre-requisites in the list of courses for each semester. Students will need to ensure that they have fulfilled the pre-requisite requirement before registering for certain courses.

6. Course Selection

Students are required to select their courses prior to their arrival at USM. A list of courses offered to exchange students will be available at the International Office of each exchange partner institution by the end of March each year.

7. Course Registration

Course registration process will be carried out on the second day of the orientation week. There will be a short briefing on the courses offered by representatives of each school prior to the registration. A class schedule for each course will also be distributed. Students are allowed to do minor changes in the course selection after the briefing.

Students are required to complete a course registration form and to return it to the International Office by the end of the orientation week. In completing the course registration form, students are advised to pay serious attention to the following:
• Course Code
• Unit of each course
• Name of lecturer and building & room numbers
• Total number of units required by home institution
• No clashes in the Class Schedule
• Announcement on special meetings by course coordinators prior to the beginning of classes.

The International Office will carry out the online registration for each student, based on the information provided in the registration form. Students are then required to check and sign the course confirmation form at the end of the first week of the semester.

Changes in course registration can be made until the third week of the semester after which students are only allowed to withdraw from courses. A penalty of RM50 per course will be imposed to those who under certain circumstances, are required to register a new course/courses after the third week. Course withdrawal period ends on the sixth week of semester. Any request to drop a course/ courses after the sixth week has to be forwarded to the Deputy Vice-Chancellor [Academic and International Affairs] for decision. If approved, students are allowed to drop the course[s] with a penalty of RM 50.00 per course.

8. Attendance

Attendance at lectures, tutorials, seminars, laboratory and field-work is **COMPULSORY**. If under unavoidable circumstances, a student needs to be excused from any classes, then he/she is required to inform the lecturer concerned before or after the class. A Medical Certificate from the Health Centre or any of the panel doctors is required if a student is on sick leave. A minimum attendance of 70% must be attained by the student or he/she will be barred from sitting for the final examination.

9. Assessment

Assessments are in the form of coursework, tests, and examinations. A breakdown of each component and its marks will be provided in the course outline, which is distributed usually on the first day of classes.

10. Examinations

Examinations are compulsory except for courses registered as audit (Y).

All examinations are conducted during the three weeks examinations period and are coordinated by the Examinations Unit at the Academic Division of the Registry. However, students should note that for small classes, (25 students and less), schools are permitted to organize the examinations. You will have to check the schedule in the respective schools.

A draft timetable will be released around the 8th or 9th week of the semester, and will only show proposed dates of examinations and course codes. Students should then inform the Examination Unit before the dateline specified in the draft if they have any problems relating to the proposed dates. Study Abroad students are advised not to make any travel arrangements until the final timetable is released.

The final timetable will show the course codes, dates, times and venues of the papers and copies of both the draft and final timetable will be displayed on the main notice boards at the foyer of the Chancellory, the Libraries and schools. A copy will also be placed in the USM International Office. Students are advised to record the dates, times and venues for their courses correctly. Any student who misses an examination on a scheduled date will be recorded as **ABSENT** and given **0 marks** unless the Examination Unit receives a report of extenuating circumstances from the student, within 48 hours from the time of the examination paper, which is acceptable to the University Examinations Council.

All examinations are held on the University Campus and request for examinations to be conducted at student's home institution can only be considered under the following situation:
i.   A student needs to return home due to the starting of a new semester at the home institution. This request is to be supported by a letter from the home institution mentioning the date for registration at the home institution.
ii. A student needs to go back to his/her country for medical treatment. A letter of support from a local doctor is required.
iii. Other reasons deemed fit to be given permission by the Senate of the University.

Please take note that the examinations will be organized only when the following conditions have been fulfilled.
a. The student has completed at least 12 weeks of study at USM.
b. The home institution is willing to conduct the examination by providing the necessary invigilation and venue.
c. The examination can be conducted at the same time and date as that run at USM or
d. The lecturer(s) concerned is willing to set another examination paper for the student.

Students are required to produce their examination slips in order to sit for the examination. The examinations slip is produced by the Examinations Unit and is released to students during the study week (a week prior to the start of the examinations). Students are required to print it out from their Healthy Campus Student's Account. Any inquires regarding examinations must be made directly to the Principal Assistant Registrar, Examinations Unit, Level 5, Chancellory Building.

11. Grading

Universiti Sains Malaysia follows the CGPA system and the grading are as follows:

A	4.00	B-	2.67	D+	1.33
A-	3.67	C+	2.33	D	1.00
B+	3.33	C	2.00	D-	0.67
B	3.00	C-	1.67	F	0.00

Students who achieve a CGPA of 2.00 and above are classified as in the "ACTIVE" category.

12. Examinations Results & Transcript

Provisional results are available usually a month after the examinations end and the final results are released about two weeks after the provisional results. Transcripts of examinations results for study abroad students will be sent to the address in their home country and home institution unless the International Office is informed otherwise.

13. Appeals Regarding Examination Results

Appeals regarding examination result should be forwarded to the Principal Assistant Registrar, Examinations Unit, Level 5, Chancellory Building in writing together with a copy of the receipt of payment of RM 25.00 per course. The appeals procedure involves not only the examinations Unit but also the school concerned and hence the outcome may take a while.

14. Telephone Numbers for Academic Purposes

USM International: +604-653 2778 / 2771
Examinations Unit: +604-653 3123
Data Processing and Records Unit: +604-653 3211

15. Facsimile, Address and Emails of USM International Office

Facsimile: +604 653 2781
Address: USM International
Division of Academic & International Affairs
Universiti Sains Malaysia
11800 Minden Penang, Malaysia
Email: studentexchange@usm.my

For any general inquiries regarding the courses, students are advised to contact the respective schools:

School	Email
Graduate School of Business	gsb@usm.my
School of **Arts**	dean_arts@usm.my
School of **Biological Sciences**	dean_bio@usm.my
School of **Chemical Sciences**	dean_chs@usm.my
School of **Communication**	dean_comn@usm.my
School Of **Computer Sciences**	dean@cs.usm.my
School of **Educational Studies**	dean_edu@usm.my
School of **Housing, Building & Planning**	dean_hbp@usm.my
School of **Humanities**	dean_hum@usm.my
School of **Industrial Technology**	dean_ind@usm.my
School of **Languages, Literacies And Translation**	dean_sollat@usm.my
School of **Management**	dean_pengurusan@usm.my
School of **Physics**	dean_phy@usm.my
School of **Social Sciences**	dean_soc@usm.my
School of **Chemical Engineering**	chazlina@eng.usm.my
School of **Civil Engineering**	dean_civ@eng.usm.my
School of **Electrical And Electronic Engineering**	dean_ee@eng.usm.my
School of **Materials and Mineral Resources Engineering**	afauzi@eng.usm.my

Course Code/ Title	Unit	Semester Offered	Synopsis	Details of Lecturer
AGW 610 Finance & Accounting for Management	3	I	This course is essential for those undertaking the Master of Business Administration where students are provided with a strong foundation in the application on principles, theories, concepts, practices, interpretations and issues of Accounting and Finance. This course covers the core knowledge of the essential features of financial accounting, management accounting and financial management from the perspective of a non-business major. It is highly practical course that will help students to increase your understanding of the use of accounting and finance in the business context. It will increase your confidence and understanding in financial matters, develop your skills in analysing and interpreting financial and accounting information, particularly in the context of the organisation's strategy, its competitors and its industry. This course also covers relevant topics to nurture students to be better at decision making, both on day-to-day matters and investment decisions, increase your ability to communicate effectively with company accountants and understand how and why value is created by businesses for sustainability. By the end of the programme, students will be able to communicate effectively and confidently on financial matters within your organisation. **Assessment:** Coursework 50%, Final Examination 50%	Dr. Sofri Yahya 04-653 2880 sofri@usm.my
AGW 612 Corporate Strategy	3	II	This course is the capstone class of the MBA curriculum. Like most courses in Strategic Management, it shows how all aspects of the organisation are involved in developing strategy. The course focuses on the tasks of top managers (chief executive officers, presidents, and division managers) as they formulate and implement the strategies that set the general direction of an organisation and thus critically affect its success. One task is developing an understanding of a company's current position and its historical development. A second task is generating and evaluating strategic alternatives and selecting from them. A third task is coordinating all the operational and functional components of the organisation, such as managing the classic tension between marketing and production. **Assessment:** Coursework 50%, Final Examination 50%	Dr. Suhaimi Shahnon 04-653 2524 sshahnon@usm.my
AGW 613 Management & Organizational Behavior	3	I & II	The course provides students with qualities needed to create work atmosphere with intelligence, enthusiasm, a strong work ethic, a team orientation, and a genuine concern for people. This course is aimed at understanding the environment, common structure, design processes, individual and interpersonal influence, and group behavior in an effective way. A primary objective is learning to manage organizations effectively, through people and by people. **Assessment:** Coursework 50%, Final Examination 50%	Sem I Dr. Mohamad Hossein Motaghi 04-653 2317 motaghi@usm.my Sem II Ms. Junaimah Jauhar 04-653 2530 naimah@usm.my

Course	Credit	Semester	Description	Contact
AGW 614 Managerial Economics	3	I & II	Managerial economics is a fundamental part of the business curriculum. It deals with strategic and tactical decisions made by managers, analysts and consultants in both the private and public sectors of the economy. The course introduces the students to the principles and tools of analysis in the microeconomic theory of the firm. It stresses on the application of economic theory and methodology to business decision making. The topics covered in the course include demand and supply analysis, production and cost, output and pricing decisions in various market structures, special pricing practices, game theory and markets with asymmetric information. **Assessment:** Coursework 50%, Final Examination 50%	Prof. Lai Yew Wah 04-653 2521 ywlai@usm.my
AGW 615 Advanced Business Statistics	3	I & II	To provide quantitative basis through suitable statistical techniques to collect, analyze, interpret and present data and results, based on which valid inferences and policy actions are to be determined. Also, to create a statistical base in all functional areas of management for appropriate decision-making. **Assessment:** Coursework 50%, Final Examination 50%	Assoc. Prof. K. Jeyaraman 04-653 2332 dr_kjraman@usm.my
AGW 616 Management Information System	3	I & II	To stress the strategic importance of information and knowledge. An introduction to Management Information Systems: • What it is • How it affects organizations and their employees • How it can make businesses more competitive and efficient To show why Information Systems are essential for: • Creating competitive firms • Managing global corporations • Providing useful products and services to customers **Assessment:** Coursework 50%, Final Examination 50%	Assoc. Prof. Noornina Md. Dahlan 04-653 2760 nina@usm.my
AGW 617 Operations Strategy	3	I & II	This course will encourage and nurture your strategic and analytical thinking in operations, regardless of your professional background. Operations is the underpinning pillar for successful implementation of any project and routine tasks in traditional subjects such as marketing and finance, and any other subjects requiring management of processes. Understanding the strategy underlying operations is even more vital for mature professionals who need to make key decisions affecting the resources within the organization. Nevertheless, strategic thinking in operations needs to be contextualized to current and foreseeable challenges in the business environment. Therefore, professionals undertaking this course will have the opportunity to analyse cases in key topics such as vertical integration, process technology, capacity, sourcing, suppy chain and lean operations within the context of developing sustainable organizations. **Assessment:** Coursework 50%, Final Examination 50%	Dr. Ellisha Nasurddin 04-653 2529 ellisha@usm.my Dr. Tan Cheng Ling 04-653 2787 ellisha@usm.my

AGW 618 Marketing Management	3	I & II	This course is essential for those undertaking the Master of Business Administration and will lay a strong foundation in your understanding on principles, theories, concepts, practices, interpretations and issues of Marketing Management (MM). You will be taken on a journey to understand what the marketplace is all about, especially concerning consumer needs and wants; and industry responses in terms of the application of the marketing mix elements in the world of trade to ensure marketing success. Effective marketing does not just happen. It requires effective management processes in relation to product, price, place and promotion decisions. MM aims to enhance business performance by applying market orientation strategies either internally and/or externally for the purpose of achieving organization objectives. Since marketers must know the 'what' and 'how' of marketplace works, this course is designed to provide in-depth coverage of all the marketing mix elements and thus illustrate to students through cases how they are applied in the business world. To make this happen, everyone are expected to share their own workplace experience in class. **Assessment:** Coursework 50%, Final Examination 50%	👤 Assoc. Prof. Nabsiah Abdul Wahid 📞 04-653 3880 🖱 nabsiah@hotmail.com
AGW 619 Corporate Finance	3	I & II	This course focuses on the role of the financial manager in creating value within a business organization. It provides exposure to the tools and issues for financial decision making in a firm. Thus, the main focus of the course are on understanding: i) tools for financial decisions, ii) valuation of stocks and bonds, iii) strategic corporate investment decisions (which project to take), and iv) strategic financing decisions (optimal dividend payout policy and capital structure). **Assessment:** Coursework 50%, Final Examination 50%	👤 Prof. Datin Ruhani Hj. Ali 📞 04-653 3954 🖱 ruhani@usm.my
AGW 621 Research Methodology	3	I & II	The principal aim of this course is to assist students in the process of identifying research topics and problems, and to provide them with a logical framework in which to consider such problems, the associated methodologies and the results. Both quantitative and qualitative approaches will be emphasized in the course. Research in areas of business has grown, and continues to grow very rapidly. The ability not only to structure one's own investigations, but also to be able to evaluate critically the work of others, is of great importance. The course will therefore also provide a forum in which students can actively develop their critical skills. By the end of the course all students are expected to have identified a research topic in consultation with the course facilitator and supervisor, and to have developed a research proposal for assessment. **Assessment:** Coursework 50%, Final Examination 50%	👤 Prof. Datin Hasnah Haron 📞 04-653 3435 🖱 hhasnah@usm.my 👤 Dr. Siti Nabiha Abdul Khalid 📞 04-653 2759 🖱 nabiha@usm.my

Course	Credit	Semester	Description	Contact
AGW 624 Business Issues & Sustainable	3	II	This course discusses the concepts of corporate social responsibility (CSR) in businesses to achieve sustainability. CSR is an important concept for all businesses to be sustainable in the future. It encompass a wide issue ranging from managing of the welfare of human capital of the organization, providing a positive work culture in the organization, implementing proper control system and also ensuring that production, pricing and goods delivered to the final customer are safe for consumption and are produced with technology that is least harmful to the environment and society. The CSR terms will be use interchangeably with sustainable development in this course. The course will combine theories on CSR/ sustainable development and will also expose students to the practical "real-life" examples by the industry. People from the industry will be invited to share their experiences with the class. In this course, there will be a combination of class lecture and guest speakers from the industry. Students are expected to prepare a one-page report of each topic that the guest speaker will be sharing their experiences on at the beginning of the class, and at the end of the talk, there will be real case issues/problems that the invited guests will be sharing with the class and inviting the students to participate. The week after the guest lecture, the students are required to share the lessons learned from the lecture and how it actually can be linked up to the theoretical aspects of CSR that have been discussed in class. **Assessment:** Coursework 50%, Final Examination 50%	Dr. Azlan Amran 04-653 2754 azlan_amran@usm.my
AGW 626 International Trade	3	II	This course emphasizes on trade theories and policies. Questions such as causes of trade, benefits from and its distribution, causes and instruments of protections and its costs instruments have to be considered. Economic implications as a result of increase mobility of labour and capital are also being explored. With reference to the classical trade model, it was found out that the implications for trade and welfare to increase scale of return and competition is far from economic reasoning. Emphasis is also given to the form of institutional world trade with discussion on the evolution of WTO. In this subject the content will be delivered in both passive and interactive forms. The former covers such teaching methods as lecture presentations supported by lecture notes, textbooks and other written materials. The more interactive teaching will encompass tutorial participation by students via discussions, presentation of assigned work and classroom debates. Students are encouraged to participate in the learning environment offered information from the Internet (e-mail, discussion groups, and bulletin boards). **Assessment:** Coursework 50%, Final Examination 50%	Assoc. Prof. Hassan Ali 04-653 2895 hasanali@usm.my

AGW 631 Sustainability Issues & Concept	3	I	This course is one of the specialisation courses that is compulsory for those undertaking the Master of Business Administration (Sustainable Development). This is a foundation course meant to help students understand the whole concepts of Sustainable Development and Sustainability. This is an introductory course before taking the rest of specialisation courses in the following semester. Sustainability is most commonly defined as meeting the needs of the present generation without compromising the ability of future generations to meet their own needs. It is characterized by three overarching concerns: maintaining ecological and environmental health; creating economic welfare; and ensuring social justice. This course introduces students to the theory, principles, and practices of sustainability as approached through a variety of topical concerns and academic fields. Some of the pertinent questions to be addressed are: Is the earth headed for ecological collapse, and if so, what can be done to avert catastrophe? How can humanity's growing needs be met without mortgaging the future? Are there economically viable ways to ensure an equitable and prosperous life for the citizens of the planet? Is a sustainable world primarily to be achieved through green design and technology, or by changing consciousness and behaviour? What are the characteristics of sustainable lives and businesses, and what practical means are at our disposal to achieve these goals? In providing the answers, the course will also feature guest lectures by other faculty and scholars whose research intersects with sustainability concerns. A system approach will be introduced to ensure student will appreciate the different approach and perspective of this course. **Assessment:** Coursework 50%, Final Examination 50%	Dr. Azlan Amran 04-653 2754 azlan_amran@usm.my
AGW 632 Natural Resources & Environmental Management	3	II	The course focuses on two main areas under natural resource and environmental management: natural resource planning and policy and natural resource economics. In order to provide hands-on flavor and to relate issues with theoretical tools, the students will also be exposed to the understanding and experiences of natural resource degradation and conservation, using case studies of mangrove degradation and conservation in Malaysia and other countries. The course begins with issues such as uncertainty and complexities that characterized environmental and resource management situations and the different approaches and strategies used in environmental planning and decision-making. Students will then be introduced to techniques in assessing alternatives – Cost-Benefit Analysis, Impact Assessment and Life Cycle Assessment. The students will also be exposed to alternative approaches to impact assessment by examining the Adaptive Environmental Management Approach and the more conventional Programmed Strategies for implementing environmental policies and programmes. Interest representation will also be covered in relation to planning and assessment. The section on natural resource planning and policy ends by looking at issues in the stages of implementation, monitoring and auditing. The environmental and natural resource economics section begins by relating and extending Cost-Benefit Analysis to environmental quality by showing how damages to the environment can be estimated and how environmental cost and benefits can be incorporated in project design and appraisal. This section continues by introducing the students with techniques of evaluating environmental quality from the benefit side, which include Market Value or Productivity Approaches, the Human Capital or Foregone Earnings Approach, the Wage Differential Approach, Travel Cost Approach and Survey Based Evaluation techniques that measure people's preferences either their willingness to pay or accept for some environmental change. The students will also be exposed to environmental quality valuation from the cost side which includes the Preventive Expenditure Method, the Replacement Cost Approach and the Shadow Project Approach. The following section is on the economics and management of the environment which covers externalities, market allocation, air and water pollution, and toxic substances. The final section deals with the allocation and management of the various types of depletable and renewable resources. **Assessment:** Coursework 50%, Final Examination 50%	Prof. Lai Yew Wah ywlai@usm.my Dr. Salfarina Abd. Gapor farina@usm.my Dr. Khairun Yahya khairun@usm.my 04-653 2521 / 2665

Course	Credits	Semester	Description	Contact
AGW 633 Green Business & Performance Assessment	3	II	The main objective of this course is to educate learners on the concept of green business from a sustainable development perspective and what sustainability-based indicators mean. While the concept green business is not necessarily new to many learners of corporate social responsibility, impact assessment of green business is a new subject that is yet to be thoroughly researched and understood. Hence, learners will explore the theoretical and practical aspects in the development of sustainability-based key performance indicators (KPIs) which are oriented towards the triple bottom line. These KPIs, unlike normal KPIs, will be based on international and global standards of assessments, and overlayed with local and industry/organization-specific needs. An attention to stakeholders' needs will be part and parcel of learners' learning process. **Assessment:** Coursework 50%, Final Examination 50%	Dr. Ellisha Nasruddin 04-653 2529 ellisha@usm.my
AGW 651 Service Management	3	I	This course is essential for those undertaking the Master of Business Administration (SSME) and will lay a strong foundation in your understanding on principles, theories, concepts, practices, interpretations and issues of Service Science, Management and Engineering. The economy and economies of all developing nations are moving into primarily of service jobs (wtih the gross domestic product comes primarily from service. Experts suggest that the growth rate will increase over time. The aim of this course is to give students the exposures of what service is, why it is different from other sectors and other jobs, and why it is. Students will learn about issues in service, such as measuring performance, maximising productivity, increasing quality, and creating innovation to ensure sustainability. **Assessment:** Coursework 50%, Final Examination 50%	Dr. Tan Cheng Ling 04-653 2787 chengling.tan@gmail.com
AGW 652 Accounting for Service	3	I	This is a new course on the role of accounting in services industry. This course will discuss the importance of accounting in services organisation, and how it can contribute to the capital market or the industry in hand per se. This course has a strong focus on research papers and arguments, rather than on the methods of accounting used in services industry. It is imperative to know why such accounting methods are being used rather than how to use it. Specifically, it focuses on management and cost accounting in services industry. Of course, some issues on other roles on accounting will be mentioned. **Assessment:** Coursework 50%, Final Examination 50%	Dr. Effiezal Aswadi Abdul Wahab 04-653 2755 effiezal.wahab@gmail.com
AGW 657 Service Quality & Productivity	3	II	1. To provide a forum for discussion on productivity and quality concepts from different aspects of management 2. To adapt statistical process control techniques for the continuous quality improvement in the modern business service environment 3. To focus on the applications of some widely used statistical / mathematical models in Service operations management which will help in making decisions in business organizations To interlink the managerial problems with Statistical software. **Assessment:** Coursework 50%, Final Examination 50%	Assoc. Prof. Suhaiza Hanim Mohamad Zailani 04-653 2786 shmz@usm.my Assoc. Prof. K. Jeyaraman 04-653 2332 dr_kjraman@usm.my

Course	Credit	Semester	Description	Instructor
AGU 609 Human Resource Management	3	I & II	This course is essential for those undertaking the Master of Business Administration and will lay a strong foundation in your understanding on principles, theories, concepts, practices, interpretations and issues of Human Resource Management. The course provides students with a complete, comprehensive review of essential personnel/human resources management concepts and techniques in an understandable form. Since managers have personnel-related responsibilities, this course is aimed at all students of management, not just those who will some day carry the title "Human Resource Manager" or "Personnel Manager." A primary objective is learning "how to learn from experience." **Assessment:** Coursework 50% Final Examination 50%	Assoc. Prof. Zainal Ariffin Ahmad 04-653 2605 drzaba2001@yahoo.my
AGU 610 International Business Management	3	II	The growth of an international business market has become a major concern among countries that striving to compete globally. With intense global market competition and the so called global economy take it shape, it requires that domestic and foreign **business** managers have the knowledge of cultural, economic, political and legal environments of international **business**. International business managers are also required the necessary managerial skills for making management decisions in an **international** context. The concepts and principles relating to international business trade and investment, international strategies, control systems and risk management will help the managers to manage and strategising their conduct of activities in competitive environment. Managers in international business activities are exposing to various management and decision. An adequate knowledge and information about the background of the countries that the business conducted are equally important for the managers to manage successfully. **Assessment:** Coursework 50%, Final Examination 50%	Dr. Sofri Yahya 04-653 2880 sofri@usm.my
AGU 615 International Financial Management	3	II	This course covers the concepts and mechanics of international money and capital markets. It includes exchange rate dynamics and forecasting, discussion of exchange rate risk and exposure management, sources of International Finance and international capital budgeting techniques. The course will also include an assessment of the implications of taxation in international business decision making, and foreign investment and exchange controls. **Assessment:** Coursework 50%, Final Examination 50%	Datin Dr. Joriah Muhammad 04-653 3880 joriah@usm.my
AGU 643 Strategic Marketing Management	3	I	This is a capstone course for marketing students. The course strengthens the fundamental knowledge of marketing, and focuses on the application of marketing management to analyze marketing problem of business enterprises. Theoretical and practical understanding of marketing will be applied to analyzing, formulating, and implementing marketing strategies for organizations. Marketing personnel must be able to develop effective strategies to ensure the survivability of an organization. To be able to develop an effective marketing strategy, marketing personnel must be exposed to the tools and techniques of marketing decision making. In this course, students will be exposed to the tools and techniques of analyzing marketing problems. Decision making skills which include analyzing the environment, identifying the major problem, identifying the best alternative, developing plan to implement the best alternatives and evaluating the effectiveness of the decision will be exposed to the students. At the end of the semester, students are expected to acquire the skills of developing effective marketing strategies for an organization. Students are also expected to acquire effective oral and written communication skills. **Assessment:** Coursework 50%, Final Examination 50%	Prof. Osman Mohamad 04-653 3416 osman@usm.my

AGU 644 International Marketing	3	I	Malaysian economy is trade dependent. The need to create Malaysian firms capable of competing internationally has long been recognized. The shift in industrial policy from import substitution to export-oriented industrialization strategy has led to the growth and increased importance of the manufacturing sector in the Malaysian economy. The challenges of marketing high value-add manufactured products in the global markets differ from that exporting raw materials and commodities. With increasing liberalization and competition, Malaysian companies must reposition and integrate into the global economy. **Assessment:** Coursework 50%, Final Examination 50%	Prof. Osman Mohamad 04-653 3416 osman@usm.my
AGU 655 Managerial Ethics	3	II	The recent accounting scandals like Enron, WorldCom, and Tyco have demonstrated that managerial decision-making almost always has ethical implications. This course will examine how values and principal shape the conduct of business in the development of our societies. Hence, it will focus on what businesses and professionals ought to engage in or not engage in rather than about how to stay out of jail. Nevertheless, legal implications too will be given some consideration. **Assessment:** Coursework 50%, Final Examination 50%	Assoc. Prof. Dato' Ishak Ismail 04-653 2332 iishak@usm.my
AGU 657 Leadership	3	I	This course offers a unique blend of theory and application. The purpose of this course is to expose you to scientific theories and researches in behavioral sciences that will help prepare you more fully for the leadership challenges you will face in your organization. Our study on theory will be punctuated with the perspectives of your own leadership experience, either as a leader, follower or observer, in real life situations. You will also have the opportunity to develop specific leadership skills and to practice these skills in exercises and class projects. The study of leadership characteristics and variables is a challenging prospect. This course won't magically transform you into the next Donald Trump, Jack Welch, Richard Branson or Steve Jobs. However, through the academic study of leadership, you can learn the strengths and limitations of your own leadership style. Through self-assessment, the scholarly review of the body of leadership research and reflection, you will become a more effective leader of character. Our emphasis throughout the course will be on learning the theory of behavioral sciences concepts and learning how to apply them to your everyday experiences. **Assessment:** Coursework 50%, Final Examination 50%	Dr. Shahrul Yazid Yahaya shahrul.y.yahaya@gmail.com Tuan Hj. Noor Nasir Kader Ali nnasir@usm.my 04-653 2528
AGU 658 Entreprenuership In Global Business	3	II	AGU 658 is an option course for post graduating students majoring in International Business. Creating and growing a new venture inside or outside the corporation is a task that few individuals are able to accomplish, even though many profess the desire. The process of transforming creative idea into commercially viable businesses is a major challenge for those who want to succeed in business. In the process, managers and individuals in the organizations learn the trade of entrepreneurship and become intrapreneurs. This course is based on an understanding of all the functional areas of business and applies the tools and analytical techniques of these functional areas to the new venture creation process in a local and international setting. **Assessment:** Coursework 50%, Final Examination 50%	Tuan Hj. Noor Nasir Kader Ali 04-653 2528 nnasir@usm.my

Course Code/ Title	Unit	Semester Offered	Synopsis	Details of Lecturer
VPA 101E Cross-Cultural Design	4	I	The study of philosophies, practices and development of ancient South East Asian traditional designs. Each product will be analyzed in terms of its intrinsic philosophy. A comparative study of the primary as well as secondary features of the products will also be made. Students are expected to be able to discern prominent features that identity to a particular tradition. **Assessment:** Coursework 60%, Final Examination 40%	Mr. Hasnul Jamal Saidon 04-653 3267 dir_muzium@notes.usm.my
VRS 105E Fundamental of 3 Dimensional Studio	2	I & II	This is a basic course in 3 dimensional design. The students are exposed to the elements and principles of design, problem solving techniques, materials and construction method. Students will be given projects based on formal and abstract works with emphasis on lines, shape, color, value and composition. These projects will be 3D in nature **Assessment:** Coursework 100%	Ms. Noor Azlina Mohamed Khalid 04-653 4652 azlinakhalid@gmail.com
VRA 111E Fundamental of Computer Graphics	4	I & II	This is an introductory course in the application of computer as a tool to generate images and typography. Students are exposed and trained in new graphic and animation soft ware which will be used in creating print and pre print works. **Assessment:** Coursework 100%	Ms. Azila Zainal azilazainal@usm.my
VLP 101E Fundamentals of Acting	3	I	This course expose students to basic preparations as an actor. These include self-introduction, space, equipment and interaction among colleagues. The core of this course is to eliminate inhibitions within themselves and having an open mind in enchancing their creativity as an actor. **Assessment:** Coursework 100%	Assoc. Prof. Abdul Samat Salleh 04-653 2386 asamat@usm.my
VLP 119E Technical Theatre I - Stagecraft	4	II	This paper is a study of the stagecraft, with emphasis on theory and practical aspects. a. The aspects of the functions of stagecraft and staging b. Equipment in creating the stagecraft c. Producing the 'standard flat', door, window and stairs d. How to link and support the stagecraft e. Forms and functions of a bench in designing the set f. How to draw the 'floor plan', front and back of 'elevations' as well as the painter's elevation [a 3 – dimensional rendition] g. How to render backdrops and matters related to stagecraft **Assessment:** Coursework 60%, Final Examination 40%	Dato' Prof. Emeritus Mohamed Ghouse Nasuruddin 04-653 2386 mdghouse_nasuruddin@yahoo.com
VLP 116E Fundamental of the Art of Traditional and Contemporary Dance	4	II	This studio-lecture deals with elements of movement, and emphasises the mixture of Eastern and Western movements in order to apply to a series of movements for a finalised suitable theatre genre. **Assessment:** Coursework 60%, Final Examination 40%	Dr. Mumtaz Begum Aboo Backer 04-653 3623 mumtazbacker2002@yahoo.com

Course	Units	Sem	Description	Lecturer
VLP 229E Technical Theatre II - Lighting	4	I	This course deals with theory and lighting methods in theatrical performances. It focuses on: a) Function and the quality of light b) Lighting design c) Electrical basic: studies on parallel and series of circuits using principles pertaining to Ohm in solving various calculation relating to voltage etc d) Optical aspect: studies on matters relating to reflection on various reflectors e) Form and functions of lights in theatre f) Application and control of colours in theory g) Dimmer system – manual and memory h) Creating light plot and organising lighting cues **Assessment:** Cousework 60%, Final Examination 40%	Dato' Prof. Emeritus Mohamed Ghouse Nasuruddin 04-653 2386 mdghouse_nasuruddin@yahoo.com
VLP 225E Directing II	4	II	This course concentrates on directing based on non-conventional methods. Students are expected to improvise storyline/script, image or idea in producing a production. **Assessment:** Course Work 100%	Ms. Janet Pillai Abdullah 04-653 3417 janetpillai@gmail.com
VZM 148E Basic Vokal and Instrumental	2	I	This course equips the students with functional keyboard skills. Students will learn scales, basic chord progressions, harmonizations and transpositions. Apart from studying basic repertoire, students are also taught sight reading and score reading. **Assessment:** Coursework 100%	Mr. Victor Kam Soo Teck 04-653 4077 yumiyoshioka@gmail.com
VZM 327E Pedagogi and Repertoir Instrumental	4	I	This course is designed to further enhance student comprehension of the psychology of instrumental teaching. Emphasis will be placed on methodology, acquisition of creative skills, and theories of motivation. Students will also be guided to sharpen their interpretative ability by means of exploring a myriad of compositions from all musical periods. **Assessment:** Coursework 40% Final Examination 60%	Dr. Yumi Yoshioka 04-653 2333 yumiyoshioka@gmail.com
VZM 197E Keyboard	2	II	The students are exposed to a higher level of chord progressions, harmonizations and transpositions. The students also continue with repertoire learning, sight reading and score reading. **Assessment:** Coursework 100%	Dr. Abdul Razak Aziz 04-653 3417 aarazak@usm.my
VZM 182E Contemporary Music Ensemble I	2	II	This is a practical course in performance. The focus is on creating music and making instruments. Students may choose from a variety of musical groups: chamber and musical sound ensembles. Besides practice, theoretical ideas on style, form and creativity will be considered **Assessment:** Coursework 100%	Mr. Victor Kam Soo Teck 04-653 4077 victor@usm.my
VZM 238E Conducting and Score Reading	2	II	This course introduces students to the basic art of conducting rhythmic patterns. Musical scores of different levels will be discussed and analyzed. Students will be required to orchestrate and to conduct scores for chamber ensemble, big band and orchestra. **Assessment:** Coursework 100%	Assoc. Prof. Razif Mohd. 04-653 3623
VZM 202E Basic Music Technology	2	II	This course introduces students to basic electronic music from a theoretical as well as historical perspective. The application of electronic medium in music composition will be studied. Students will learn notational programmes such as SIBELIUS and FINALE. **Assessment:** Coursework 100%	Mr. Johan Awang Othman 04-653 2484 johan_othman@yahoo.com

Course Code/ Title	Unit	Semester Offered	Synopsis	Details of Lecturer
BOI 109 Biostatistics	4	I	The course includes a discussion on variability in biological data; probability distribution for binomial, Poisson and normal distributions. To give students some basic training on the use of statistics for data analysis in biological research. Topics to be discussed include variability of biological data, hypothesis testing (including non-parametric), as well as correlation and regression. It is hoped that after going through this course, the students will have a better idea on how to properly present their data and will be able to analyse their data using the most appropriate statistical method/s in order to make a good inference and conclusion on their research results. Hypothesis testing for one and two samples, including parametric and non-parametric methods; correlation and regression. The second part of this course will discuss sampling and sample size (for one and two samples); one and two way analysis of variance; experimental design – randomized complete block, Latin square; treatment designs such as factorial experiments; special techniques in biology. **Assessment:** Coursework 40%, Final Examination 60%	Prof. Baharuddin Salleh 04-653 4001 sallehb@usm.my

School of **Chemical Sciences**

Course Code/Title	Unit	Semester Offered	Synopsis	Details of Lecturer
KAT 141 Analytical Chemistry I	3	I & II	Stoichiometry calculation, 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. **Assessment:** Coursework 30%, Final Examination 70%	Assoc. Prof. Wan Saime Wan Ngah 04-653 3569 wsaime@usm.my
KFT 131 Physical Chemistry I	3	I & II	Properties of gases and liquids: gas laws, van der Waals equation, kinetic theory of gases, principle of the corresponding states, Maxwell-Boltzman distribution, effusion, diffusion, viscosity, thermal conductivity, conduction and mobility. Chemical kinetics: rate laws, temperature effect, experimental methods, complex reactions. First law of thermodynamics: work, heat, energy, enthalpy change, heat capacity, adiabatic and isothermal processes, reversible and irreversible processes. Thermochemistry. **Assessment:** Coursework 30%, Final Examination 70%	Dr. Afidah Abdul Rahim 04-653 3913 afidah@usm.my
KTT 111 Inorganic Chemistry I	3	I & II	This course will introduce topics in basic chemistry such as stoichiometry, atomic structure, nuclear chemistry, periodic table, chemical bonding and properties of matter. **Assessment:** Coursework 30%, Final Examination 70%	Assoc. Prof. Farook Adam 04-653 3567 farook@usm.my
KOT 121 Organic Chemistry I	3	I & II	Electronic structure and bonding. Acids and bases. An introduction to organic compounds: nomenclature and representation of structure. Reactions of alkanes, alkenes, alkynes and dienes. Stereochemistry: the arrangement of atoms in space, the stereochemistry of addition reactions. Delocalised electron and resonance. Reactions at a sp^3 hybridized carbon: nucleophilic substitution of alkyl halides, elimination of alkyl halides and compounds with leaving groups other than halogen. Structure, synthesis and reactions of alcohols. **Assessment:** Coursework 30%, Final Examination 70%	Dr. Abdussalam Salhin Mohamed Ali 04-653 3562 abdussalam@usm.my
KUT 101 Chemistry Practical I	2	I & II	The experiments were extracted from the book: J. H. Nelson and K. C. Kemp, Laboratory Experiments for Chemistry: The Central Science, 10th Edition, Pearson Prentice Hall (2006). **Assessment:** Coursework 100%	Assoc. Prof. Wan Saime Wan Ngah 04-653 3569 wsaime@usm.my
KUT 102 Chemistry Practical II	2	I & II	The experiments were extracted from the book: J. H. Nelson and K. C. Kemp, Laboratory Experiments for Chemistry: The Central Science, 10th Edition, Pearson Prentice Hall (2006). **Assessment:** Coursework 100%	Assoc. Prof. Wan Saime Wan Ngah 04-653 3569 wsaime@usm.my

Course	Units	Semester	Synopsis	Lecturer
KAE 248 Advanced Practical - Analytical Chemistry	2	II	Practical applications of analytical techniques in areas such as forensic sciences, food and adulteration of milk, cooking oil and drinks, toxic materials, toxic metals **Assessment:** Coursework 100%	👤 Dato' Prof. Muhammad Idiris Saleh 📞 04-653 4027 🖱 midiris@usm.my
KAT 241 Analytical Chemistry II	3	I & II	Basic principles, instrumentation and applications in qualitative and quantitative analyses of the following techniques: • Electroanalytical • Spectroscopic • Chromatographic **Assessment:** Coursework 30%, Final Examination 70%	👤 Dr. Amat Ngilmi Ahmad Sujari 📞 04-653 3637 🖱 angilmi@usm.my
KAT 244 Separation Methods	3	II	Solvent extraction. Solid-phase extraction. General principles of chromatography. Gas chromatography. High performance liquid chromatrography: partition, adsorption, ion and size exclusion (gel) chromatography. Planar chromatography: thin layer and paper chromatography. Capillary electrophoresis. Selected methods. **Assessment:** Coursework 30%, Final Examination 70%	👤 Dato' Prof. Muhammad Idiris Saleh 📞 04-653 4027 🖱 midiris@usm.my
KAT 242 Spectroscopic Methods	3	I	Basic principles, instrumentation and the applications in qualitative and quantitative analyses of the following techniques. Molecular ultraviolet and visible absorption spectrometry, infrared absorption spectrometry, fluorescence spectrometry, flame emission spectrometry, atomic absorption spectrometry (flame and non-flame methods), atomic emission spectrometry with plasma and electrical discharge sources, x-ray fluorescence and mass spectrometry. **Assessment:** Coursework 30%, Final Examination 70%	👤 Prof. Norita Mohamed 📞 04-653 4049 🖱 mnorita@usm.my
KAT 243 Analytical Practical I	2	I	Experiments based on the following methods: infrared spectrophotometry, ultraviolet-visible spectrophotometry, spectrofluorometry, flame photometry, atomic absorption spectrometry, gas chromatography, high performance liquid chromatography. **Assessment:** Coursework 100%	👤 Prof. Mohd. Asri Mohd. Nawi 📞 04-653 4031 🖱 masri@usm.my
KFT 232 Physical Chemistry II	3	II	First, Second and third laws of thermodynamics, work, heat and energy, enthalpy change, heat capacity, adiabatic expansion, entropy, Gibbs and Helmholtz energies, chemical potential, fugacity, open system and composition change. Changes of State: physical transformation of pure substances and mixture. Phase diagram, stability of phases, Clapeyron equation, partial molar quantities, thermodynamics of mixing, properties of solution, activity, phase diagram for systems with two and three components. Electrochemistry: Debye Huckel theory, electrochemical cell, electrode potential and thermodynamics of cell. **Assessment:** Coursework 30%, Final Examination 70%	👤 Assoc. Prof. Seng Chye Eng 📞 04-653 3546 🖱 ceseng@usm.my

Course	Units	Semester	Synopsis	Lecturer
KIT 252 Unit Operations	3	II	Unit conversion. Material balance: flowsheet prototype of chemical process; general balance equation, technique in material balance, various unit balances, chemical reactions, stoichiometry, extent of reactions, recycles. Energy balance: energy balance equations for closed systems, approximation of enthalpy changes and applications, heat capacity, reactive systems, enthalpy, balance equations and energy balance techniques. Liquid flow: type of liquids, compressible and incompressible. Newtonian and non-Newtonian, flow region, laminar flow and turbulent, Reynolds number, boundary layer, balance equation for materials and energy, momentum equations, flow in pipes. Heat transfer: mechanism, shell and tube heat exchangers, basic equations, general coefficient of heat transfer. Separation process, characteristic of separation, phase equilibrium, binary distillation. Some examples of unit operations equipment. **Assessment:** Coursework 30%, Final Examination 70%	Assoc. Prof. Mohamad Nasir Mohammad Ibrahim 04-653 3554 mnm@usm.my
KIT 253 Chemical Engineering Thermodynamics	3	I	Concept and definitions: Thermodynamic systems, process and cycles. Work, Energy and Heat: Work and heat definition. Work and heat through system boundary. Work and heat units. **Assessment:** Coursework 30%, Final Examination 70%	Assoc. Prof. Ahmad Md. Noor 04-653 3552 mnahmad@usm.my
KIT 254 Polymer	2	II	Introduction to polymer: Basic concepts and definitions; general properties and characteristics; polymer recycling; molecular structure; cross-linking; molecular configuration; copolymer. **Assessment:** Coursework 30%, Final Examination 70%	Ms. Che Su Endud 04-653 4032 chesu@usm.my
KIT 257 Material Chemistry	3	I	Introduction: Classification of materials; Relation between structure, processing and properties. • Atomic Structure and Chemical Bonding • Imperfection in Solid • Diffusion in Solids • Ceramics • Polymers • Metals and Alloys • Composites • Phase Diagrams • Properties of Materials • Corrosion and Degradation of Materials **Assessment:** Coursework 30%, Final Examination 70%	Assoc. Prof. Mohd. Jain Noordin Mohd. Kassim 04-653 4023 mjain@usm.my
KOE 223 Mechanisms in Organic Reactions	2	I	The meaning of reaction mechanisms. Energy profile diagrams. Intermediates vs. transition states. Methods of determining mechanisms. Structure/reactivity correlations. Molecular rearrangements **Assessment:** Coursework 30%, Final Examination 70%	Dr. Yam Wan Sinn 04-653 3558 wansinn@usm.my
KOT 222 Organic Chemistry II	3	I	Identification of organic compounds; mass spectrometry, infrared spectroscopy, ultraviolet/visible spectroscopy and NMR. Structure, synthesis and reactions of ethers, epoxides, ketones and aldehydes. Aromatic compounds: aromaticity, reactions of benzene and substituted benzenes. **Assessment:** Coursework 30%, Final Examination 70%	Dr. Oo Chuan Wei 04-653 3680 oocw@usm.my

Code & Title	Units	Semester	Description	Contact
KTT 212 Inorganic Chemistry II	3	1	Introduction to coordination chemistry: relevant bonding theories and metal-metal bonds. Preparation and characterisation of basic organometallic compounds will be emphasized. Discussion on various techniques to identify the compounds includes FT-IR, FT-NMR, MS and X-ray diffraction. Applications of organometallic compounds. **Assessment:** Coursework 30%, Final Examination 70%	Prof. Wan Ahmad Kamil Mahmood 04-653 3262 wakcm@usm.my
KUT 203 Chemistry Practical III - Inorganic	2	I & II	Basic techniques of preparation and characterisation of inorganic compounds. This course includes the following list of experiments. Students need to carry out the experiments selected from the list and they have to refer to the Practical Manual KUT 203/2:- 1. Studies on a metal complex, potassium trioxalatoaluminate (II) trihydrate $K_3[Al(ox)_3].3H_2O$. 2. Preparation and conductivities of complex compounds $[Co(NH_3)_4CO_3]NO_3$ and $[Co(NH_3)_5Cl]Cl_2$. 3. Synthesis of bis (triphenylpohosphine) copper(II) borohydride, $(Ph_3P)_2CuBH_4$. 4. Complex ion composition using JOB's method. 5. The chemistry of vanadium. 6. Electronic spectra of coordination compounds. 7. Preparation and resolution of the tri(ethylenediamine)cobalt(III) ion into its optical antipodes. 8. Characterisation of the linkage isomers: nitropentaaminecobalt(III) chloride, $[Co(NH_3)_5NO_2]Cl_2$ and nitritopentaaminecobalt(III) chloride, $[Co(NH_3)_5ONO]Cl_2$ 9. The electronic spectra of some copper(II) complexes. **Assessment:** Coursework 100%	Dr. Rosenani S.M. Anwarul Haque 04-653 3578 rosenani@usm.my
KUT 204 Chemistry Practical IV - Physical	2	I & II	This course contains the following set of experiments. Only 12 out of 15 experiments will be selected for each semester. 1. Primary salt effect. 2. Determination of the vapour pressure and molar enthalpy of vapourisation of 2-propanol. 3. Determination of the rate constant of a second order reaction using electrical conductance. 4. Simultaneous determination of chloride-iodide mixture: Evaluation of K_{sp} for AgCl and AgI. 5. Determination of heat and entropy of solution of potassium hydrogen tartrate ($C_4H_5O_6K$) at 35°C. 6. Determination of the dissociation constant of an indicator. 7. Thermodynamics of electrochemical cells. 8. Fractional distillation. 9. Heterogeneous equilibrium: the three component liquid system with incomplete miscibility. 10. Determination of molecular weight of high polymer by viscosity method. 11. Hydrogen bonding between phenol molecules. 12. Electrochemistry of solution. 13. UV spectra of conjugated carbonyl. 14. Adsorption photometry - simultaneous analysis of a two-component mixture of Cr^{3+} and Co^{2+} spectrophotometrically. 15. Kinetics of the persulfate-iodide reaction. **Assessment:** Coursework 100%	Assoc. Prof. Rohana Adnan 04-653 3549 r_adnan@usm.my
KUT 205 Chemistry Practical V - Analytical	2	I & II	Experiments involving ultraviolet-visible and infrared spectroscopy, ion exchange resin, fluoride ion selective electrode, flame emission and atomic absorption spectroscopy, high performance liquid chromatography, gas chromatography and electrogravimetry. **Assessment:** Coursework 100%	Dato' Prof. Muhammad Idiris Saleh 04-653 4027 midiris@usm.my

KUT 206 Chemistry Practical VI - Organic	2	I & II	Basic organic techniques in chromatography (thin-layer, column and gas-liquid), fractional distillation, extraction and isolation techniques, spectroscopy (NMR, IR, UV & MS) and classical qualitative analysis are introduced through a series of compulsory experiments. This is followed by several experiments which expose the student to a selection of techniques in physical organic chemistry (such as the investigation of resonance energy related to unsaturated a, b carbonyl system) and preparative organic chemistry involving some distinct reactions e.g. the Diels-Alder, pinacol-pinacolone rearrangement and the Michael conjugate addition). **Assessment:** Coursework 100%	Assoc. Prof. Hasnah Osman 04-653 3558 ohasnah@usm.my
KAE 345 Special Topics in Analytical Chemistry	3	I	The current trends and advances in various aspects of analytical chemistry will be discussed. **Assessment:** Coursework 30%, Final Examination 70%	Dato' Prof. Muhammad Idiris Saleh 04-653 4027 midiris@usm.my
KAE 346 Pollution and Environmental Chemistry Practical	2	II	Analysis of lead pollution, analysis of hydrocarbon pollution, BOD analysis, COD analysis, phosphate analysis, nitrogen analysis, determination of chlorine in water, kinetics of iron(II) oxidations in water, nitrate analysis in ground water and jar test for coagulation studies. **Assessment:** Coursework 100%	Prof. Mohd. Asri Mohd Nawi 04-653 4031 masri@usm.my
KAT 340 Analytical Practical II	2	I	Operational amplifiers and logic gates in chemical instrumentation. Experiments based on ion chromatography, high performance liquid chromatography, gas chromatography, atomic absorption spectroscopy (AAS), graphite furnace (AAS), ICPMS, electroanalytical methods, UV/Vis spectrophotometry. Literature search. **Assessment:** Coursework 100%	Dr. Amat Ngilmi Ahmad Sujari 04-653 3637 angilmi@usm.my
KAT 341 Pollution and Environmental Chemistry	3	II	Water pollution: Hydrological cycle; causes and effects of man-made pollution; oxygen-sag in river pollution; monitoring of pollution strength; treatment processes. Air pollution: Origins of air pollutants; basic chemistry of the formation of combustion-generated pollutants; basic chemistry of the formation of combustion-generated pollutants; analytical methods and monitoring of atmospheric pollutants; atmospheric chemistry; atmospheric dispersion, control of emissions to the atmosphere. **Assessment:** Coursework 30%, Final Examination 70%	Prof. Mohd. Asri Mohd. Nawi 04-653 4031 masri@usm.my
KAT 347 Electroanalytical Methods	3	I	The principles of electrochemistry, signal generation, double layer, polarization and over voltage. The potentiometric method: Principles of ion selective electrodes (ISE) and analyses of H, Na, K, Ca and F ions. The solid state type ISE. The voltammetric methods: Principles of polarography (Hg electrode) and analyses of metals and non-metals. Principles of amperometry (C and Pt electrodes) and analyses of complexes and organics. **Assessment:** Coursework 30%, Final Examination 70%	Assoc. Prof. Sulaiman Ab. Ghani 04-653 4030 sag@usm.my

Code				Description	Contact
KFT 331 Physical Chemistry III	3	I		Quantum theory: Wave-particle duality, postulates, uncertainty principle, Schroedinger equation, particle in one dimensional box, harmonic oscillator, rigid rotor.	Assoc. Prof. Rohana Adnan
				Statistical thermodynamics: Boltzmann distribution, ensemble, partition functions, calculation of thermodynamic functions.	04-653 3549
				Kinetics: transition state theory, thermodynamics of reactions, reaction solution, reactive species, photochemical reactions, oscillating reactions.	r_adnan@usm.my
				Dynamic electrochemistry: electric double layer, rate of charge transfer, polarisation, fuel cell, corrosion.	
				Assessment: Coursework 30%, Final Examination 70%	
KIE 355 Industrial Colourants	3	I		Basic concepts of colour: Electromagnetic spectrum and visible light; colour vision and colour perception; colour specifications; colour measurement; absorption and reflectance of light by colorants; fluorescence in organic molecules; colour mixing; colour matching and colour difference.	Ms. Che Su Endud
				Colour and constitution of organic molecules: General structure of colorants; Light absorption and electronic transitions; resonance; structural effects on l_{max}.	04-653 4032
				Classification of colorants: Chemical classes; application classes; types of textile fibres.	chesu@usm.my
				Chemical classes of dyes and pigments: Azo; carbonyl; phthalocyanine; polyene; polymethine; arylcarbonium ion.	
				Chemistry and application of synthetic dyes: Direct; acid; basic; disperse; vat; mordant; metal-complex; sulfur; azoic; reactive; mechanism of interactions with textile fibres.	
				Pigments: Organic and inorganic pigments; application methods.	
				Functional colorants: Dyes for special applications (LCD, laser, solar cell); chemichromisme.	
				Assessment: Coursework 30%, Final Examination 70%	
KIE 356 Food and Palm Oil Chemistry	3	II		Carbohydrates: Classification of structures; dietary utilisation as food component, reaction-hydrolysis, dehydration and thermal degradation and browning; functions in foods.	Prof. Boey Peng Lim
				Proteins: Physicochemical properties. General properties: chemical reaction and interaction of amino acid and protein. Denaturation, functional properties of proteins.	04-653 4026
				Oil and fats: Type; composition, physical and chemical properties, quality control, stability, oxidation and anti-oxidant, processing and technology edible oils.	plboey@usm.my
				Flavours: Analysis and identification, structures and organoleptic quality, production of typical flavor substances (vanilin, saccharin etc).	
				Food additives: Role of acids, bases, salt, chelating agents, antimicrobes and types of sweeteners. Stabilisers and texturisers.	
				Structures and composition of palm oil. Chemical properties and non-fatty components. Physical properties of palm oil. Technology of palm oil. Research trends in chemistry and technology of palm oil. Practical experiments on quality controls of palm oil.	
				Assessment: Coursework 40%, Final Examination 60%	

KIE 358 Current Topics in Industrial Chemistry	3	II	This course will discuss several topics or current issues in Industrial chemistry. It will cover the following areas. 1. Industrial colours and textiles. 2. Food Industry. 3. Polymer based Industry. 4. Unit operations and processing. 5. Corrosion Science. The topics will be determined each semester when the course is offered. **Assessment:** Coursework 30%, Final Examination 70%	👤 Assoc. Prof. Mohamad Abu Bakar 📞 04-653 4025 🖱 bmohamad@usm.my
KIT 355 Unit Operations Practical	2	I & II	Laboratory experiments on the basic theory and practice of unit operations. Fluid flow, rheology, mixing process, conduction and radiation, process of evaporation, absorption, distillation, extraction, humidification, drying and filtration. **Assessment:** Coursework 100%	👤 Assoc. Prof. Mohamad Abu Bakar 📞 04-653 4025 🖱 bmohamad@usm.my
KIT 356 Chemical Processing	4	I	Introduction of Industries in Malaysia: Introduction of several aspects and characteristics of Malaysian Industries. Types of local raw materials, utilisations and products. Raw materials for Inorganic Industriles: Source of raw materials used in Inorganic Industries. Economics of raw materials. **Assessment:** Coursework 30%, Final Examination 70%	👤 Prof. Boey Peng Lim 📞 04-653 4026 🖱 plboey@usm.my
KIT 357 Industrial Practical	2	I & II	Industrial related practical: Preparation and application of dyes, wood analysis, metal extraction and electroplating, metal corrosion, food chemistry, ceramics and polymers. **Assessment:** Coursework 100%	👤 Ms. Che Su Endud 📞 04-653 4032 🖱 chesu@usm.my
KOE 322 Natural Products Chemistry	3	II	Chemistry and properties of biological molecules, fats and steroids. Vitamins. Monosaccharides, disaccharides and polysaccharides. Amino acids and proteins. Nucleic acids. Mechanisms of enzymic reactions. Biogenesis and biosynthesis of various main groups of natural products - terpenes, alkaloids, polyketides and shikimic acid derivatives. Other compounds which will also be described include prostaglandins, insect pheromones, antibiotics and current topics of interest. Chemistry of natural product molecules or their synthetic analogs of pharmaceutical or agricultural importance. **Assessment:** Coursework 30%, Final Examination 70%	👤 Prof. Boey Peng Lim 📞 04-653 4026 🖱 plboey@usm.my
KOT 323 Organic Chemistry III	3	II	Structure, synthesis and reaction of amines, carboxylic acids and carboxylic acid derivatives. Condensations and alpha substitution of carbonyl compounds. Carbohydrates, nucleic acids, amino acids, peptides and proteins **Assessment:** Coursework 30%, Final Examination 70%	👤 Assoc. Prof. Wong Keng Chong 📞 04-653 3556 🖱 kcwong@usm.my
KTE 311 Selected Topics in Inorganic Chemistry	3	II	The chemistry of main group cluster compounds, transition metal cluster complexes, halogen, phosphorus-nitrogen compounds, and organosilicon shall be discussed and elaborated. Several advanced topics in the areas of organometallics, reaction mechanisms and current development in inorganic chemistry may also be discussed. **Assessment:** Coursework 30%, Final Examination 70%	👤 Prof. Teoh Siang Guan 📞 04-653 3565 🖱 sgteoh@usm.my

KTT 313 Inorganic Chemistry III	3	I	Ring, chain, cage and cluster of inorganic compounds. Halogen and inert gases: halogens in positive oxidation states, halides and pseudo-halogen. Extension of coordination chemistry: complex structures and reaction mechanisms. **Assessment:** Coursework 30%, Final Examination 70%	Prof. Teoh Siang Guan 04-653 3565 sgteoh@usm.my
KUE 309 Chemistry Project	6	I & II	Research projects on various chemistry topics. **Assessment:** Coursework 100%	Prof. Bahruddin Saad 04-653 4027 bahrud@usm.my
KUT 307 Chemistry Practical VII - Inorganic and Analytical	2	I & II	Spectra of metal carbonyls. Electronic spectra of coordination compounds. Preparation and resolution of tris (ethylenediamine)cobalt(III) into optical isomers. Preparation of ferocene and its acetyl derivative. Application of IR spectroscopy to characterise linkage isomer, nitropentaaminecobalt(III) chloride and nitropentaaminecobalt. Photometric titrations with UV-VIS spectroscopic method. Determination of aluminium with 8-hydroxyquinoline through fluorimetric method. Flame photometry. Atomic absorption spectrophotometry. Kinetic method for the determination of selenium. **Assessment:** Coursework 100%	Assoc. Prof. Sulaiman Ab. Ghani 04-653 4030 sag@usm.my
KUT 308 Chemistry Practical VIII - Physical and Organic	2	I & II	Spectra of metal carbonyls. Electronic spectra of coordination compounds. Preparation and resolution of tris (ethylenediamine)cobalt(III) into optical isomers. Preparation of ferocene and its acetyl derivative. Application of IR spectroscopy to characterise linkage isomer, nitropentaaminecobalt(III) chloride and nitropentaaminecobalt. Photometric titrations with UV-VIS spectroscopic method. Determination of aluminium with 8-hydroxyquinoline through fluorimetric method. Flame photometry. Atomic absorption spectrophotometry. Kinetic method for the determination of selenium. **Assessment:** Coursework 100%	Assoc. Prof. Ahmad Md. Noor 04-653 3552 mnahmad@usm.my

Course Code/ Title	Unit	Semester Offered	Synopsis	Details of Lecturer
YBP 221E Planning and Evaluation of Communication Campaigns	3	I	This course exposes students to the techniques of strategic campaign planning including: problem and needs identification, objective formulation, strategic and message development, media planning, management planning, training, implementation and evaluation. Students are expected to plan a campaign based on an identified problems **Assessment:** Coursework 60%, Final Examination 40%	Dr. Hasrina Mustafa 04-653 2631 hasrina@usm.my
YBP 325 Creative Communication Production	3	I	This course continues the teaching and learning process on communication campaign started in YBP221. As an applied course which focuses on the building of skills for campaign implementation, students produce creative campaign materials based on the following steps: (1) identification of campaign problem and need assessment, (2) objective formation positioning, (3) audience analysis and segmentation, (4) media selection, (5) message design and development of creative materials and (6) pre-testing of media materials. This course takes a multi-disciplinary approach by applying theories from social psychology, sociology, education and communication. **Assessment:** Coursework 60%, Final Examination 40%	Assoc. Prof. Khor Yoke Lim 04-653 2640 ylkhor@usm.my
YFP 221E Audio Production	3	I	The course begins with an introduction to basic principles and techniques in audio production. The course also explains and discusses the various formats of audio production, i.e. entertainment programme, interview, news, advertisement, public service announcement and social campaigns. The students are asked to plan and run a number of audio continuity sessions (live broadcasts) by playing the roles of announcers, news reader and interviewers. **Assessment:** Coursework 70%, Final Examination 30%	Dr. Juliana Abd. Wahab 04-653 4066 Julia@usm.my
YWP 328E Visual Communication & Journalism	3	I & II	This course exposes students to the importance and uses of visual elements, particularly photography, in communication. This course combines theory and practice, and covers theories, principles, and ethics of using visuals in publication and photo journalism. Students are exposed to photo editing and layout softwares including Adobe In design and Adobe Photoshop. **Assessment:** Coursework 100%	Assoc. Prof. Adnan Hussein 04-653 3603 adnan@usm.my
YBP 228E Publicity, Media & Methods	3	II	This subject is designed to provide students with the skills and techniques to utilize both the print and electronic media effectively from a public relations perspective. Good publicity equals good media relations. A good media relation requires thoughtful plans and targeted strategies. It is much more than churning out news events that can be turned into positive media coverage. **Assessment:** Coursework 60%, Final Examination 40%	Dr. Jamilah Ahmad 04-653 4417 jamilah@usm.my

| YWP 222E Introduction to DTP | 3 | II | This course combines both theoretical understanding and practical skills knowledge of desktop publishing (DTP). Theoretical aspects include DTP concepts and process, elements of page design and layout, and design principles. Practical skills include mastering page layout software particularly Adobe In design and Adobe Photoshop for Windows.

Assessment:
Coursework 100% | Assoc. Prof. Adnan Hussein
04-653 3603
adnan@usm.my |

Course Code/ Title	Unit	Semester Offered	Synopsis
CPT 111 Principles of Programming	3	I & II	To introduce basic principles of programming using the C++ programming language. **Assessment:** Coursework 50%, Final Examination 50%
CPT 112 Discrete Structures	4	I	To provide an understanding of mathematical structures in terms of concepts, and properties so that students would able to choose appropriate structures for problem representation and abstraction. **Assessment:** Coursework 40%, Final Examination 60%
CST 131 Computer Organisation	4	I	To introduce the structure and function of basic digital computer units responsible for the information processing task. **Assessment:** Coursework 50%, Final Examination 50%
CMT 221 Database Organisation & Design	4	I	To expose students to basic knowledge in data processing and information and file management. To teach basic knowledge of database concepts, theory, design and management. To train students in a particular database management system to enable them to write a database application program. **Assessment:** Coursework 50%, Final Examination 50%
CMT 222 Systems Analysis & Design	4	I	To study various activities in systems development process using object-oriented i.e. analysing process, systems design and implementation including management aspects, planning, controlling, evaluation and systems evaluation methods. To give the opportunity to the students to implement a system development project. **Assessment:** Coursework 50%, Final Examination 50%
CST 231 Data Communications & Networks	3	I	To expose students to the fundamentals of data communication and networking and network protocols (TCP/IP). To introduce network errors and noise, error detection and error control. To expose students to network security at various network layers such as network and application layers, and enhance their understanding via lab practical sessions. **Assessment:** Coursework 50%, Final Examination 50%
CST 232 Operating Systems	3	I	To expose students to the fundamentals of operating systems that include memory organisation and management, process management, file and device management. To expose students to basic knowledge and practical aspects of an operating system (e.g. Linux). **Assessment:** Coursework 50%, Final Examination 50%

Course	Units	Sem	Description
CPT 113 Programming Methodology & Data Structures	3	II	To expose students to data design in C++ e.g. arrays, structures, enumeration, characters and strings. To strengthen further programming skills in C++ through topics that include recursion, object oriented design, data abstraction, and classes. To provide fundamental knowledge on abstract data types and data structures e.g. lists, stacks, queues, and binary trees using C++ and object-orientation. **Assessment:** Coursework 50%, Final Examination 50%
CPT 114 Logic & Applications	4	II	To equip students with the fundamentals of propositional logic and predicate logic that is employed in logic programming, basic understanding of its applications for formal specification in software engineering and artificial intelligence is including the use of computer programming languages to solve logical problems. **Assessment:** Coursework 40%, Final Examination 60%
CPT 115 Mathematical Methods for Computer Science	4	II	This course combines fundamental mathematics concepts with analysis through the use of software tools for mathematical analysis. Mathematics concepts such as vectors, matrices, calculus and statistics are discussed together with application examples in computer science and implementation through sofware tools. Mathematical methods that are covered include matrices, functions, differentiation, integration, differential equations, basic statistics and correlation vector analysis, complex numbers and Fourier analysis. **Assessment:** Coursework 50%, Final Examination 50%
CMT 222 Systems Analysis & Design	4	II	To study various activities in systems development process using object-oriented i.e. analysing process, systems design and implementation including management aspects, planning, controlling, evaluation and systems evaluation methods. To give the opportunity to the students to implement a system development project. **Assessment:** Coursework 50%, Final Examination 50%
CMT 223 Information Systems Theory & Management	3	II	To introduce students to contemporary information systems (IS) and explore how organizations use information technology to support operational and strategic activities. **Assessment:** Coursework 50%, Final Examination 50%
CMT 224 Multimedia Systems	3	II	To provide fundamental details on multimedia systems, applications, components, hardware and software and expose the students to the development of multimedia technology and current issues in multimedia. To introduce the development process and implementation of multimedia application and project management process. To provide practical training using multimedia authoring tools and other media development software packages. **Assessment:** Coursework 50%, Final Examination 50%
CPT 211 Programming Language Concepts & Paradigms	3	II	To introduce various programming language concepts and paradigms with a special focus on several scripting languages i.e. PERL and Java Scripting Language, Web and Internet programming i.e HTML and XML, Event-Driven programming i.e ASP and distributed programming. **Assessment:** Coursework 50%, Final Examination 50%
CPT 212 Design & Analysis of Algorithms	4	II	To introduce advanced data structures and the design and analysis of algorithms. To study a broad range of algorithms and their analysis in OOP environment that include sorting, searching, and graph algorithms. To introduce algorithms for string processing, memory management, and advanced topics on algorithms. **Assessment:** Coursework 50%, Final Examination 50%

Course			
CPT 243 Software Requirements Analysis & Modelling	3	II	To introduce requirement analysis, and software modelling in software engineering practice. **Assessment:** Coursework 50%, Final Examination 50%
CPT 244 Artificial Intelligence	3	II	To emphasise on problem solving methods, search techniques and knowledge representations in artificial intelligence. To apply the above-mentioned concepts to practical problems, such as game playing, expert systems and planning. To introduce machine learning and reasoning under uncertainty. **Assessment:** Coursework 50%, Final Examination 50%
CST 233 Information Security & Assurance	3	II	To introduce students to information security and assurance that include security in a globally connected economy, sources of digital liabilities, threats, vulnerabilities, and risk exposure, affirmative model of defense, models for estimating risk and optimising the return on security. To discuss acceptable-use policies, secure-use practices, auditing technology and systems, electronic evidence and computer forensics. **Assessment:** Coursework 50%, Final Examination 50%
CST 234 Network Programming	3	II	To introduce network programming method and TCP/IP, as well as transportation protocols such as TCP, UDP and SCTP. To explain the way of using socket programming interfacing such as select() and poll(), as well as socket options. To present the method of building server process will be presented. To apply the above knowledge to build programs such as client-server service involves accessing through network as assignments and course project. **Assessment:** Course Work 50%, Final Examination 50%
CMT 322 Web Engineering & Technologies	3	II	To explain the concepts, tools and implementation of clients and servers, implementing web-based applications, a database driven web site. To discuss framework, performance and security issues of web-based technologies. **Assessment:** Coursework 50%, Final Examination 50%
CMT 325 E-Business Strategy, Architecture & Design	3	II	To introduce E-business concepts that is required for E-business practitioners, managers and systems developers. **Assessment:** Coursework 50%, Final Examination 50%
CMT 326 Multimedia Information Systems & Management	3	II	To provide students with a thorough understanding of fundamental principles of hypermedia product development. To give a detailed process, methods and techniques used in hypermedia product development. To give a detailed description of searching and modeling of multimedia information retrieval. To discuss and survey web searching and digital library technology. **Assessment:** Coursework 50%, Final Examination 50%
CMT 327 Decision Support Systems & Data Mining	3	II	To present the fundamentals of a decision-making process, methodology, technology components and the development process of decision support systems. To introduce data mining concepts, theory and tools. **Assessment:** Coursework 50%, Final Examination 50%
CPT 345 Software Quality Assurance & Testing	3	II	To discuss quality issues in software engineering including standards, process and products. To introduce software testing concepts that includes V&V, testing and evaluation techniques. **Assessment:** Coursework 50%, Final Examination 50%

CPT 346 Natural Language Processing	3	II	To provide an introduction to some basics concepts with regards to applications, theories and techniques in natural language processing (NLP). Students will also be required to carry out some programming work to prepare them to build simple NLP systems. **Assessment:** Coursework 50%, Final Examination 50%	
CPT 347 Automata Theory & Formal Languages	3	II	To expose students to basic knowledge of computing theory, in particular the concepts related to automata theory, formal languages and computational complexity. **Assessment:** Coursework 40%, Final Examination 60%	
CST 332 Internet Protocols, Architecture & Routing	3	II	To introduce Internet Protocols namely TCP/IP, ICMP and DNS, as well as static and dynamic routing protocols, distance vector and linkage conditions, RIP and OSPF. To enable students to handle router configuration, distance network, frame cast, ATM and virtual private networks. To discuss campus network architecture and design, network security and firewalls, as well as the use of Access Control List (ACL) to control network access. **Assessment:** Coursework 70%, Final Examination 30%	
CST 335 Systems Security & Protection	3	II	To describe the needs, features and limitations of an operating system used to provide protection and security. To compare and contrast current methods for implementing security including recovery management. **Assessment:** Coursework 50%, Final Examination 50%	
CST 336 Microprocessors & Embedded Systems	3	II	To introduce microprocessors and embedded systems, and use of Assembly Language in microprocessor and embedded systems programming. **Assessment:** Coursework 50%, Final Examination 50%	

Course Code/ Title	Unit	Semester Offered	Synopsis	Details of Lecturer
PET 101 Effective Reading Skills for TESOL	3	II	The course will be divided into two parts. The first part will concentrate on improving the trainees' own reading skills. They will be involved in reading exercises using various types of reading texts and reading strategies. The second part of the course will emphasize the pedagogical skills involved in the teaching of reading for TESOL. It will extend the learners' understanding of the reading process and the teaching of reading. The learners will be able to evaluate and design reading activities in the teaching of English as a second language. Topics covered include knowledge about reading, teaching of strategies and reading skills, and problems and ideas in teaching reading comprehension in school. **Assessment:** Coursework 100%	Ms. Amelia Abdullah 04-653 4985 amelia@usm.my
PET 102 Oral Skills for TESOL	3	II	The main aim of the course is to activate and extend the students' linguistic competence, which will indirectly increase their confidence in using spoken English. Students are also exposed to ways to develop their ability to analyze and evaluate spoken performance. The spoken activities in this course will improve students' competence in face-to-face interaction. Students will also be introduced to principal components of effective speaking. At the pedagogical level, the course will develop a greater awareness of the features of spoken English and the implications of these features for developing spoken language skills for learners. The course will also increase the participants' repertoire of spoken language teaching and skills development techniques and help them select those that are most relevant for their learners. **Assessment:** Coursework 100%	Assoc. Prof. Muhammad Kamarul Kabilan Abdullah 04-653 2966 kabilan@usm.my
PET 103 Effective Writing for TESOL	3	II	The aims of this course are twofold. Firstly, this course will develop the students' ability to communicate effectively in writing with coherence and accuracy. It will provide practice in writing that reinforces the language that the students have learned. Emphasis will be given on the more global features of written English such as organization and coherence as well as the more problematic area of grammar (i.e. accuracy) to enable students to write clearly, concisely, coherently and correctly. Secondly, this course will prepare the participants to teach their learners how to write effectively. Central to all the writing assigned in this course is a combination of both the genre approach and process approach to writing. As such activities for reading and analyzing texts for successful communication patterns will be used for helping students plan their own written texts as well as training them to develop effective writing strategies for their learners. Writing is also viewed as a process of generating ideas, drafting, getting feedback, revising and editing. **Assessment:** Coursework 100%	Assoc. Prof. Mildred Nalliah 04-653 3764 padmani@usm.my

Course	Unit	Sem	Description	Contact
PET 225 TESOL Curriculum Development	4	II	The course studies the theory and practice of syllabus design and materials development. The focus of the course will be on planning (which includes needs analysis, objective setting, duration of the course, etc.), content selection (based on factual information such as proficiency level, age of the learners, education background, previous learning experiences, learning goals, etc.), implementation (including methodology) and evaluation. It will also look at developing materials for a learner-centered curriculum in which only aspects of the language most urgently required by the learners will be included. Thus, emphasis will be on designing and adapting materials to meet the specific needs of the learners. **Assessment:** Coursework 40%, Final Examination 60%	Mr. Mohamad Jafre Zainol Adibin 04-653 2557 jafre@usm.my
PET 301 Teaching of English through Literature	3	II	This course focuses on the pedagogical skills necessary for the effective teaching of literature to learners in school. As such it will make direct reference to literary texts prescribed by the Ministry of Education. This course aims to acquaint students with the techniques of teaching literature – poems, plays short stories and novels. It will help students to evaluate literary works appropriate for our school system. Furthermore, it will also examine why literature is taught, what types of literary works to be taught and how literature should be taught. **Assessment:** Coursework 40%, Final Examination 60%	Ms. Norlida Ahmad 04-653 2975 norli@usm.my
PET 424 Project Work in TESOL	4	II	Authenticity, learner autonomy and motivation are three areas that have generated continuing debate in TESOL. All the three areas can be enhanced in project work in TESOL. This course will require the students to decide on their own projects relating to the teaching of the language. Projects are conducted in a group and topics are to be decided in consultation with the lecturer. Each project must first be planned and discussed and later evaluated. Projects should extend beyond the classroom, taking the experience of the classroom out into the world. **Assessment:** Coursework 100%	Assoc. Prof. Muhamad Kamarul Kabilan Abdullah 04-653 2966 kabilan@usm.my
PGT 201E Instructional Technology Practices	3	I & II	This course presents students to the general concepts of instructional technology, which include its evolution, the domains, instructional design models, and the visual communication theories and principles. In addition, some of the technologies currently used in classrooms such as computer-assisted instruction, multimedia, electronic learning and distance learning, will also be covered in this course. The students will also learn some of the computer application skills such as creating word processing documents, desktop publishing, as well as searching information from the web. Based on the general concepts and theories, the students are required to develop a multimedia project. They also need to evaluate a selected educational/informational web site and another instructional medium. The students are also expected to be able to handle and operate some instructional media. **Assessment:** Coursework 60%, Final Examination 40%	Dr. Rozinah Jamaludin 04-653 2611 rozinah@usm.my
PGT 202E Basic Educational Measurement and Evaluation	3	I & II	This course is an introduction to the basic concepts pertaining to testing, measurement and evaluation for the classroom teachers. The focus is on item and test construction, analysis, interpretation and improvement of items in objective and subjective tests. Students need to display their mastery and skills in all the above concepts by completing a set of individual assignments. **Assessment:** Coursework 40%, Final Examination 60%	Dr. Lim Hooi Lian 04-653 3765 hllim@usm.my Dr. Aswati Hamzah 04-653 3762 aswati@usm.my

PGT 212E Mathematics Teaching Methods I	3	I	This course focuses on the theory and practice of mathematics teaching to produce effective, responsible and dedicated mathematics teachers. Students will be introduced to the aims, fundamentals and theories of mathematics education, curriculum, as well as planning of mathematics teaching and learning in secondary schools. The history of the development of important mathematical concepts as well as the effective teaching and learning strategies will be discussed. This course emphasizes mathematical contents and pedagogy, that is students will be taught to master the mathematical contents and employ the appropriate pedagogy to teach the contents. Students are encouraged to deepen their understanding of mathematical concepts and skills through problem solving according to the fundamental topics of mathematics, namely number, shape and space, as well as relationships. **Assessment :** Coursework 50%, Final Examination 50%		Dr. Chew Cheng Meng 04-653 3758 cmchew@usm.my
PGT 312E Mathematics Teaching Methods II	3	II	This course focuses on theory and practice to produce teachers of mathematics who are effective, responsible and dedicated. Students will exposed to the latest foundation and theories related to teaching and learning mathematics, the use of ICT in teaching and learning mathematics and diagnostic assessments, misconceptions in mathematics and remedial activities. Emphasis is placed on mastery of mathematics content, especially topics in the upper secondary mathematics curriculum and advanced topics in mathematics such as calculus, trigonometry, algebra, statistics and probability. Mathematical thinking and communication and effective teacher qualities are developed through group and individual projects. This course will also expose students to issues and current problems in mathematics education, based on the latest researches in Malaysia and abroad for effective professional development programmes. **Assessment:** Coursework 50%, Final Examination 50%		Dr. Shafia Abdul Rahman 04-653 3237 shafia@usm.my
PGT 315E Biology Teaching Methods	3	II	The aim of this course is to enhance the qualities of a student to play the role of a responsible and effective teacher. The emphasis of this course is mastery of content-pedagogy and effective planning of biology teaching based on current teaching and learning theories. ICT competency will be enhanced. This course emphasises the importance of teaching for meaningful learning. The focus of this course is on small group practicals to experience fully and to develop positive attitudes and moral values. This will ultimately be demonstrated in various outcomes like digital teaching materials, portfolio and team teaching experience. Issues and real classroom challenges will be discussed, as well as professional development. **Assessment:** Coursework 50%, Final Examination 50%		Dr. Norizan Esa 04-653 2569 norizanesa@usm.my
PGT 316E Chemistry Teaching Methods	3	II	he course seeks to serve as a formative experience for science education students before they begin student teaching. It is designed to open a space for discussions and reflection on methods and concerns specific to the chemistry classroom and the relationships between learning and teaching in chemistry. The broad aims of this course are to realize and justify the importance of teaching chemistry in the secondary school curriculum; to present essential concepts in chemistry and to develop understanding of effective inquiry methods and techniques for the teaching of these concepts and to demonstrate an awareness of issues associated with the study of chemistry. These issues include the relationship between science, technology and society; real world chemistry; the barriers raised by traditional science and chemistry curricula. Teaching strategies in the context of the KBSM Forms IV-V chemistry curriculum content will be explored with a focus on the relationship between science, technology and society. Authentic methods for assessing and monitoring students will be discussed. **Assessment :** Coursework 50%, Final Examination 50%		Assoc. Prof. Zurida Ismail 04-653 3762 zurida@usm.my Dr. Nooraida Yacob 04-653 2973 nooraida@usm.my

Course	Credit	Semester	Description	Contact
PGT 317E Physics Teaching Methods	3	II	This course aims to develop pre-service teachers on teaching and learning principle and critical issues in physics education. The approach adopted integrate content and pedagogy with emphasis on aspects such as learning difficulties, role of practical in concept understanding, developing thinking and creativity in physics and important attributes for physics learning. This course hopes to produce teachers who are proactive, committed, and sensitive to needs in physics education. **Assessment:** Coursework 50%, Final Examination 50%	Dr. Ong Saw Lan 04-653 3240 osl@usm.my Dr. Salmiza Sale 04-653 2977 salmiza@usm.my
PPG 210E General Science Teaching Methods	3	I	The ambition and the purpose of science education in Malaysia will be discussed. Teacher trainees will be equipped with knowledge and skills needed to teach science effectively using teaching methods such as inquiry, discovery, contextual teaching, Problem Based Learning, Brain Based Learning, cooperative learning and field study. Micro teaching will be used as a part of the procedures in training the teacher trainees with teaching techniques which includes introduction, lesson process and closure, use of teaching aid materials, inculcating science process skills, scientific attitude and noble values, and assessment. Attention will also be given on the laboratory management and Education for Sustainable Development. **Assessment:** Coursework 50%, Final Examination 50%	Dr. Mohd Ali Samsudin 04-653 2565 alisamsudin@usm.my Ms. Maznah Ali 04-653 2978 maznaly@usm.my
PGT 436E Information and Communication Technology in Education	3	II	This course aims to prepare student-teachers to be equipped with various current Interactive ICT tools and the pedagogies of using them appropriately and effectively across the curriculum. Design and development of all materials shall involve the innovative and creative application of instructional system design (ISD) and Instructional design (ID). A Problem-based learning approach with ICT will be given emphasis. **Assessment:** Coursework 100%	Dr. Leong Lai Mei 04-653 3245 lmleong@usm.my

Course Code/ Title	Unit	Semester Offered	Synopsis	Details of Lecturer
REG 231 Basic Land Surveying	3	I	This course covers the fundamental principle of land surveying including super visual surveys, chain surveys, plane table surveys, levelling surveys, traverse surveys, theodolite surveys, compass surveys and tacheometry surveys. Determination of soil volume in cut and fills works, as well as construction sites measurement. Students are required to carry out field work in conjunction with the lectures. **Assessment:** Coursework 40%, Final Examination 60%	Dr. Ahmad Hilmy Abdul Hamid 04-653 2882 Hilcom@usm.my
RPK 231 Principles of Planning	3	I	This course offers an understanding the basic principle in planning practices which includes the laws and regulation in planning, the related Development Plans at the national and local level, different procedures for preparation of layout plan, technical plans and basic requirement for planning submissions. Example of planning for different types of development area or zones are also included such as the Islamic City, rural planning, regional planning, urban renewal and development of a new township. Components that are related to development such as infrastructure, transportation, facilities, landscaping and engineering were also included as the main teaching programme. Qualitative techniques comprise urban design, tourism and landscape analyses. Development Plan evaluation , environmental and community impact assessment, Traffic Impact Assessment and Environmental Management Plans are some of the aspects covered. **Assessment:** Coursework 40%, Final Examination 60%	Mr. Jamil Jusoh 04-653 2801 jjamil@usm.my
RDG 235 Ergonomics	3	I	The human factors of man, physical and emotional. Examination of how man's senses are affected by space, form, colour, light, sound and motion. Study of the ecology of man and how tools, products and systems affects his behavior and environment. **Assessment:** Coursework 40%, Final Examination 60%	Dr. Fuziah Ibrahim 04-653 2834 fuziah@usm.my
RMK 254 Legal Studies	3	I	Students are exposed to the Malaysian legal system, laws that are relevant to construction project, criminal law, law of contract, company law, partnership law and of torts . **Assessment:** Coursework 40%, Final Examination 60%	Mr. Zulkifli Osman 04-653 3970 zulosm@usm.my
REG 265 Infrastructure Technology	3	I	This course covers the water supply systems, sewage systems, electricity generation, transmission and distribution, street lighting as well as telecommunication system. The students will be exposed to the principle of these systems, their design requirements and the design of the systems. **Assessment:** Coursework 40%, Final Examination 60%	Dr. Mohd. Rodzi Ismail 04-653 3174 / 2841 rodzi@usm.my

RPK 321 Landscape Planning	3	I	This course revolves around man and his environment with emphasis on the design of the outdoor environment. It is divided into three parts. The first part introduces man-environment relationship and its related problems. It then gives a historical account regarding man's attempts to alter the environment – especially the landscape – to suit his aesthetical and functional needs (physical and spiritual). The following two parts focus on the approaches and techniques in landscape planning and design. In landscape planning (regional level) problems of classification, assessment and evaluation of the landscape are introduced. The course applies various approaches from Ian McHarg's ecological approaches, to the latest and most sophisticated approach, are also taught. Examples of applied landscape planning focusing on conservation and recreation are described. In landscape design, design theories and principles are combined in the designed landscape elements, which take into account both social and environmental parameters. **Assessment:** Coursework 40%, Final Examination 60%,	Assoc. Prof. Jamel Ariffin 04-653 2806 jamel@usm.my
RDG 334 Theory and History of Design	3	I	The course covers the development of interior design from an early date to the present. The course aims to introduce and explore different theoretical perspectives on contemporary society and culture to examine historical issues relevant to the production of Interior Design and related fields. It also aims to develop the student's intellectual and critical awareness to enable students to become familiar with information sources, and develop their research and design ability. **Assessment:** Coursework 40%, Final Examination 60%,	Dr. Syarmila Hany Haron syarmilahany@usm.my
RPK 334 Traffic Planning	3	I	This course introduces students to the applications of methods and techniques for traffic planning analysis. The students will be exposed to a systematic traffic planning approach for efficient traffic managements; infrastructure planning, land use planning, public transportation planning, pedestrians and parking facilities and etc. **Assessment:** Coursework 40%, Final Examination 60%	Assoc. Prof. Hassim Mat 04-653 2844 hassim@usm.my
RMK 336 Valuation	3	I	An appreciation of the general basis of property valuation. Students are introduced to the concept of value, the economic basis of property values, valuation and investment principles and factors affecting property value. Emphasis is given on the five valuation methods and their application to the main types of property and also valuation for legal purposes **Assessment:** Coursework 40%, Final Examination 60%	Assoc. Prof. Nor'Aini Yusof 04-653 5235 ynoraini@usm.my
RPK 351 Urban and Regional Economics	3	I	Concept and theories of urban and regional economy and their application to urban and regional spatial structure. Methods of economic analysis of urban and regional growth. Evaluation of economic impacts of urban and regional development. Development of strategies and policies for urban and regional development. **Assessment:** Coursework 40%, Final Examination 60%	Prof. Abdul Ghani Salleh 04-653 2819 sghani@usm.my

RMK 353 Property Management	3	I	In this course a diverse range of topics in the property management profession are introduced. These include the functions of property management, property market and legislations that influence the profession. Operational aspects like the elements of leasing; acquisition and disposal of properties; record keeping and office organization including the occupant's liabilities and real estate marketing techniques. The maintenance section offers on impact study of design on future building maintenance, the principle and techniques of its administration and management; the effects of maintenance on budgets; methods of systematic maintenance; maintenance process relating to the various building elements; and computerized maintenance management systems. **Assessment:** Coursework 40%, Final Examination 60%	Dr. Linariza Haron 04-653 3164 lriza@usm.my
RMK 361 Administrative Law	3	I	Powers and application of powers (including discretionary power), organization and control of local authorities, law relating to housing, planning control, laws relating to meetings (including all types of project meetings), and matters relating to administrative powers of land administrator in land acquisition processes. **Assessment:** Course Work 40%, Final Examination 60%	Assoc. Prof. Abdul Aziz Hussin 04-653 2506 abdaziz@usm.my
REG 361 Methods of Construction	3	I	Types of soil, land clearings, earth cutting and filling, soil stabilization, compactions systems, site management, design principle of water distribution systems in housing scheme and road drainage, method of removing water from construction sites. Analysis of soil condition and establishment of design parameters, design of concrete foundations, pile foundations and constructions technology. Derivation procedure for concrete mix design using DOE and ACI methods. Quality control and assessments. Engineering principles, construction methods, monitoring operation, site supervision and maintenance. Prefabrication systems using precast concrete, steel and composite materials, industrialized building systems (IBS) and in-situ construction for high rise buildings. Design principles and construction technology for ferrocement materials in housing, marine, and other engineering applications. **Assessment:** Coursework 40%, Final Examination 60%	Dr. Hanizam Awang 04-653 2813 hanizam@usm.my
RPK 222 Conservation	3	II	Beginning with introducing students to the rational and history of nature conservation, the course progresses to the states of the various components of natural resources. It ends with selected overviews of contemporary approaches in conflict resolutions of in environmental modifications. **Assessment:** Coursework 40%, Final Examination 60%	Assoc. Prof. Mohamed Talhah Idrus 04-653 2853 mtalhah@usm.my
RMK 252 Principles of Project Management	3	II	In this course, various fundamentals and basics of organization and management are discussed through the perspective of the construction industry. The course will examine how management principles were theorized and formulated as well as an analysis on the different elements which are evident in the organisational context. The course will delve on the basic planning, monitoring and control methods used in project management. Proper management and organisation of the key elements in project management, namely time, cost and quality will be the underlying tone throughout the course. Effective application and implementation of management techniques specifically on the construction industry will be the ultimate emphasis of the course. **Assessment:** Course Work 40%, Final Examination 60%	Assoc. Prof. Abu Hassan Abu Bakar 04-653 3174 / 2845 abhassan@usm.my

Course	Unit	Sem	Description	Contact
REG 261 Building Services	3	II	This course covers the water supply system, sanitation systems and the electrical and mechanical systems in buildings which include the security system, fire safety system, transportation, lighting systems and air-conditioning and mechanical ventilation (ACMV) systems. The students will be exposed to the principle of the systems followed by the design of the systems. **Assessment:** Coursework 40%, Final Examination 60%	Assoc. Prof. Ir. Nik Fuaad Nik Abllah 04-653 3793 nfuaad@usm.my
REG 264 Introduction to Information Technology	3	II	The course will expose students to the use of information technology (IT) in design and construction. It will include planning, development and management of IT; while giving appropriate attention to the needs of designers, constructors and managers who are responsible for the implementation of the built forms. Discussion will concentrate on the management of information at the project, product and organisation level. **Assessment:** Coursework 60%, Final Examination 40%	Mr. Wan Burhanuddin Wan Abidin 04-653 2500 wburhan@usm.my
RPK 343 Social Aspects of Planning	3	II	This undergraduate seminar course reflects various social issues related to the development field, generally, and in the field of housing, building and planning, specifically. In general, discussions with sociological tinge will be conducted such as: social change and social planning; social and physical development, relationship between the two social issues and questions related to housing and community planning; social aspects of urban structure. Measurement of social cost and benefit, contribution of social indicators, from the perspective of social change and their usage in the fields of housing and planning. Students are required to choose from a few selected topics, within the Malaysian context, for their seminar paper presentation purposes. **Assessment:** Coursework 40%, Final Examination 60%	Dr. Rahmat Azam Mustafa 04-653 2805 razam@usm.my
RAK 344 History and Theory of Architecture	3	II	Historical explanations of world architecture are at best eurocentric hence, the understanding of world architecture is limited within the pre-packaged cultural confines. To go beyond these confines, especially to account for the events in the development of human civilization as a whole, a different vantage point is necessary. This course looks at history from an understanding that power flux provides a more holistic explanation of the development of the human civilization. This relocates the customarily euro centrically defined Egyptian, Greek, Roman, European, Modern and contemporary architecture to enable the introduction of the other architecture, especially that of Asia, known traditionally as Eastern Architecture which includes the architecture of India, China and Japan (architecture of Asia is further explored in RAK442E History and Theory of Architecture 2, Local Architecture). **Assessment:** Course Work 40%, Final Examination 60%	Assoc. Prof. Ahmad Sanusi Hassan 04-653 2835 sanusi@usm.my
RAK 345 Housing Studies	3	II	The course outlines housing concepts, policies and human settlements. It also touches on the relationship between urban and housing, as well as housing qualities and needs. It also gives an overview on housing resources which are: land, finance and technology. It also covers the aspect of housing for low income group and squatters housing. There is an overview of housing strategies and alternative approach as well as project planning with feasibilities studies, site analysis, physical and social aspects of housing. The course also touches on the relevant laws affecting housing such as Town and Country Planning Act, Street and Drainage Act, National Land Code, Uniform Building Bye-Laws, Housing Developers Act, etc **Assessment:** Coursework 40%, Final Examination 60%	Mr. Wan Hanafi Wan Hassan 04-653 2815 hanafihassan@usm.my

Code / Course	Units	Sem	Description	Lecturer
RMK 354 Construction Law	3	II	Students are exposed to building contracts (standards forms, defects liability, main-subcontractors relationship), the professionals (appointment, registrations, civil and criminal liabilities), payments (including advance payment, LAD, progress), security and guarantees, alternative disputes resolutions, other laws relating to property development, including planning. **Assessment:** Coursework 40%, Final Examination 60%,	Assoc. Prof. Abdul Aziz Hussin 04-653 2506 abdaziz@usm.my
RMK 356 Construction Management and Finance	3	II	This course is the continuation subject in Construction Management. The objective of this subject is to expose the students to processes and practices in the construction management. This subject is divided into two parts. Part 1: This part discusses the issues related to Project Management, which consist of the aspects of organization, contractual administration, procurement, planning and controlling of projects, site management and communication. Part 2: This part discusses the issues of finance in the construction management. **Assessment:** Coursework 40%, Final Examination 60%	Dr. Abd. Hamid Kadir Pakir 04-653 2837 hamka1@usm.my
RMK 357 Land Administration	3	II	Land is at the basis of all societies. Sound land policy regulates the access to land and the management of land, and as such is considered an important factor in the realisation of government policy objectives. This course aims to introduce students to the current practice of land administration in Malaysia and develop their understanding of the various issues associated with land administration, in particular its implications on real estate market and development **Assessment:** Coursework 40%, Final Examination 60%	Mr. Mohd. Yahaya Mohd. Daud 04-653 3162 myahaya@usm.my
REG 363 Site Investigation	3	II	The course covers the principle of site investigation, principle of soil mechanics, soil properties and various types tests conducted on soil. **Assessment:** Coursework 40%, Final Examination 60%	Dr. Noor Faisal Abas 04-653 2829 nfaisal@usm.my

Course Code/ Title	Unit	Semester Offered	Synopsis	Details of Lecturer
HPA 201E Major Themes in Selected World Religions	4	I & II	This course aims to expose undergraduates to the knowledge of the world major living religions which are relevant to Malaysia such as Islam, Judaism, Christianity, Hinduism, Buddhism, Sikhism, Taoism/Confucianism and the Shamanic traditions. It also seeks to provide interpretative themes for understanding diverse religious views in Malaysia. It provides undergraduates with an understanding of the different religions in Malaysia and will address some of the major issues like forms of belief, religious ideas, practices and worldviews. The students will be exposed to the field of religion in both its functional and theoretical aspect. The historical development of particular religious communities, the relations among them, and the analysis of religion in a variety of historical and cultural contexts will also be discussed. The undergraduates equipped with such knowledge will encounter new ways of understanding these religions. Topics that will be covered will include origins and historical developments, scriptures, theologies and doctrines, rites and ritual, salvation, death and the afterlife. **Assessment:** Coursework 30%, Final Examination 70%	Assoc. Prof. Muhammad Azizan Sabjan 04-653 3869 mazizan@usm.my Assoc. Prof. Noor Shakirah Mat Akhir 04-6532862 shakirah@usm.my
HST 241 History of Modern Souheast Asia	4	I	This course is an introduction to the history of Southeast Asian entities from the early arrival of the European powers till their emergence as independent sovereign states during the course of the 20th century. This course will begin with an introduction of the structures and patterns of authority of the early Southeast Asian entities. An understanding of how traditional Southeast Asian states functioned and the focus on authority and culture will be an essential backdrop to the understanding of the consequences of European contacts and ultimately subjugation of these entities. What were the changes brought about by contacts with western maritime nations who came first to trade and subsequently Conquer and colonise? What social, political, cultural and economic impact did western colonisation have on the various Southeast Asian societies? How did Southeast Asian societies view and come to terms (if ever) with the process of colonisation? Does colonisation end with the granting of political independence? If not, can colonisation take another form in the newly independent Southeast Asian states? The course will try to ascertain whether colonisation and Westernisation are synonymous with modernisation in Southeast Asian societies? While most Southeast Asian nations emerged only after the advent of colonisation, it is necessary to gauge the positive and negative features of the western colonial interlude on the subsequent development of the independent nation states of Southeast Asia. **Assessment:** Coursework 30%, Final Examination 70%	Dr. Muhamad Hasrul Zakariah 04-653 3871 hasrul74@usm.my

HFI 302E Islamic Philosophy	4	II	The principal aim of this course is to expose students to the historical development of Islamic philosophy from its early stages to the present era. Areas of inquiry included in this course: (a) The essential writings and ideas of renown Islamic thinkers such as al-Farabi, Ibn Sina, al-Ghazali, Ibn Rushd, Ibn Tufayl, Suhrawardi, and Mulla Sadra. (b) Vibrant city-centres that play host to the flourishing of Islamic philosophy – Baghdad, Cordoba, and Isfahan. (c) Prominent and influential schools of thought in the history of Islamic philosophy such as the Masha'iyyah, al-Hikmah al-Ishraqiyyah, and al-Hikmah al-Muta'aliyyah. (d) Islamic philosophy's relation to the other Islamic fields of science, theology, and mysticism. **Assessment:** Coursework 30%, Final Examination 70%	Assoc. Prof. Zailan Moris 04-653 3333 zailan@usm.my
HFP 303E Asian Thought: Indian, Chinese and Japanese	4	II	This course aims to furnish students with a fundamental knowledge of Indian, Chinese, and Japanese philosophies. Selected areas of inquiry within Indian thought range over the traditions and philosophies of Hinduism and Buddhism. A biographical sketch of Siddhartha Gautama and especially his momentous spiritual experience will be included in this component of the course. Sacred texts such as the *Vedas, Upanishads, Bhagavad Gita,* and *Dhammapada* constitute essential references for discussion. In the Chinese Thought component, emphasis will be placed upon the philosophical systems of Confucius, Mencius, Laozi, and Zhuangzi. We will explore concepts embedded within the teachings of Confucius such as *Ren, Yi, Li, Jünzi, Xiao,* and *Chong.* We will also examine the primordial and pervasive influence of the concept of *Ren* upon the thinking of Confucius and Mencius. The writings of *Daoist* philosophers, Laozi and Zhuangzi, will be thoroughly studied. Important concepts germane to this school of thought, *Dao, De, Wu-Wei, Yin-Yang* and *Xüan* will be clarified and discussed. For the Japanese Thought segment, special attention will be given to the importance of political development, socio-economic structure, mindsets, cultural traits, religion, and the consequences of interacting with the West, that collectively impact upon the formation of Japan's civilization. The premise of this approach is that socio-cultural developments in history and intellectual dynamics are mutually determinative. **Assessment:** Coursework 30%, Final Examination 70%	Mr. Peter Gan Chong Beng 04-653 2878 petergan@usm.my Dr. Ratna Roshida Abd. Razak 04-653 3871 ratna@usm.my Assoc. Prof. Lok Chong Hoe 04-653 3331 chlok@usm.my

Course Code/ Title	Unit	Semester Offered	Synopsis	Details of Lecturer
IBG 102 Biology for Technologists	3	II	This course discusses the importance of the Biology discipline as a source of raw materials in the development of the field of Bioprocess. Biological sources comprising of microorganisms, plants and animals are the sources of biological materials of commercial value, e.g. biological biomass, metabolites, natural extracts, pharmaceuticals, macromolecules, etc. Components of biological sources with importance as industrial sources will be discussed. Discussion covers the major macromolecule, biological characteristics, material composition, extraction methods, control of production of the materials and their uses in industrial processes. Various basic techniques and skills in the handling and analysis of biological sources, detecting the presence of the desired biological materials and ensuring the stability of activity will be learn. **Assessment:** Coursework 40%, Final Examination 60%	Dr. Liong Min Tze 04-653 2114 mintze.liong@usm.my
IBG 202 Industrial Microbiology	3	I	This course discusses the involvement of microorganisms in industrial processes, specifically in the production of materials from microorganisms, such as enzymes, antibiotics, organic solvents, cell biomass, etc. Emphasis will also be given to the determination of important industrial microorganisms, selection and isolation methods, maintenance, storage and improvement of industrial microorganisms as well as the involvement of microorganisms in various industries. **Assessment:** Coursework 40%, Final Examination 60%	Ms. Wan Nadiah Wan Abdullah 04-653 2113 wnadiah@usm.my
IBG 203 Bioanalysis I	3	I	This course covers the aspects of laboratory safety and sampling techniques. Emphasis will be given to the principles and methods of chemical analysis for the determination of protein, carbohydrate, oil and fat. This course will also introduce instrumental methods that involve the colorimetric and spectroscopic principles of UV-Vis, IR, AA and flame emission, NMR and mass. **Assessment:** Coursework 40%, Final Examination 60%	Assoc. Prof. Norziah Mohd. Hani 04-653 2222 norziah@usm.my Dr. Fazilah Ariffin 04-653 5208 fazilah@usm.my
IBG 211 (IBG 204) Bioanalysis II	3	II	This course emphasizes on the methods and principles of instrumental analyses, specifically chromatography (gas chromatography, high performance liquid chromatography, thin layer chromatography, gel chromatography, ionic and affinity chromatography), thermogravimetry and heat differentiation analyses, x-ray diffraction, electron microscopy, pH and potentiometry, voltametry, fluorescence, polarography, radioisotope techniques, electrophoresis and immunoassay. **Assessment:** Coursework 40%, Final Examination 60%	Dr. Sufia Hena 04-653 5213 sufiahena@yahoo. co.in

Course	Units	Semester	Description	Contact
IBK 201 Fundamentals of Bioprocess Technology	3	I	This course introduces an important discipline in the development of modern biology. The aspects covered include the definition of the bioprocess discipline, scope and the importance of the discipline of bioprocess, requirement of supporting knowledge in disciplines such as Biological Sciences, Biochemistry, Microbiology, Chemistry, Engineering, Process Control and Industrial Management. The position of the discipline of Bioprocess in the Biotechnology discipline will be clarified. Discussion also will encompass comparisons between chemical process and bioprocess. **Assessment:** Coursework 40%, Final Examination 60%	Dr. Rosma Ahmad 04-653 2118 rosmah@usm.my
IBK 411 (IBK 205) Quality Assurance and Safety of Bioprocess Products	3	II	Students will be introduced to food and pharmaceutical products including cosmetic products produced from bioprocess method or biotechnology: Challenges and opportunities will be discussed, vis-à-vis, yield and food and pharmaceutical products including cosmetics derived from gene modification: bio-safety issues and social aspects – toxicity effects, allergy, change of composition, product nutrient content including nutrition, gene stability resistance – transfer of genetic material, outcrossing (transfer of gene from GM product to the wild or plant species) and unexpected effects. Quality Assurance: Practice and Concept, sampling techniques, process control through statistical methods, food, pharmaceutical and cosmetic product quality assessment. Legislation/Regulation: Codex Alimentarius, Principles for human health risk analysis of GM food; Risk Assessment – process analysis of probability of negative occurrence towards health and its effects. Assessment is divided into: risk assessment, risk control and any communications related to risk. Sanitary and Phytosanitary Agreement of World Trade Organization is adopted for regulation of individual countries. Use of MS 1480: Standard HACCP; Current Good Manufacturing Practices; "Cartagena Protocol on Biosafety, 2000": handling aspects, transfer between boundaries, information sharing, etc. Labeling requirements: FDA and EU directives and respective countries. Food Act 1983: Food Labeling 2003. Pharmacopoeia. **Assessment:** Coursework 40%, Final Examination60%	Prof. Gulam Rusul Rahmat Ali 04-653 2216 gulam@usm.my Assoc. Prof. Noryati Ismail 04-653 2220 noryati@usm.my
IBK 316 (IBK 211) Food Bioprocess Technology	3	II	This course covers the processing of food commodities (plants and animals) via the usage of enzyme and microorganisms with the aim to increase and control quality, yield and production of value-added products. The production of food ingredients will also be included. **Assessment:** Coursework 40%, Final Examination 60%	Dr. Liong Ming Tze 04-653 2114 mintze.liong@usm.my
IBK 212 Renewable Biomass	2	II	Distribution of biomass generated and their main constituents, as well as their pattern of generation and reuse. The main sources of biomass which includes plants, animals and microorganisms and their benefits to human and environmental equilibrium is given emphasis. Generation of biomass as an alternative energy source. Rationale of Single cell protein (SCP) production, nutritional value and safety of SCP. **Assessment:** Coursework 40%, Final Examination 60%	Prof. Wan Rosli Wan Daud 04-653 2354 wanrosli@usm.my
IBG 302 Bioreactor Operation	4	I	This course will introduce various aspects involved in the fermentation process, characteristics and microorganism growth principle, and fermentation parameters including temperature, pH, aeration and agitation. Other aspects including sterilization method and concept of sterilization as well as types of fermentation such as batch fermentation, continuous fermentation, fed batch and solid state fermentation will also be covered. **Assessment:** Coursework 40%, Final Examination 60%	Ms. Wan Nadiah Wan Abdullah 04-653 2113 wnadiah@usm.my

IBG 303 (IBK 311) DNA and Metabolite Technology	3	I	This course will expose students to basic knowledge on DNA molecule and DNA technology, learning and understanding basic techniques in genetic engineering, genetic cloning application and the technology of DNA along with associated laboratory exercises. **Assessment:** Coursework 40%, Final Examination 60%	Dr. Rosma Ahmad 04-653 2118 rosmah@usm.my
IBG 311 (IBG 304) Enzyme Technology	4	II	This course will emphasize on subjects such as type and classes of enzymes, sources and production of microbial enzymes, refining and characterization of enzymes, immobilization technology, chemical adaptation of enzymes, catalysts in non-conventional systems, bio-sensory process, application analysis, the use of enzymes in bioreactor system and the use of enzymes in manufacturing industry, agriculture, medicine and waste management. **Assessment:** Coursework 40%, Final Examination 60%	Dr. Rosma Ahmad 04-653 2118 rosmah@usm.my
IBK 312 (IBK 312) Issues in Bioprocess Technology	3	II	Current developments and advancements in bioprocess technology in related issues of environment, food, agriculture, pharmaceutical and medical. Bioprocess as an alternative to conventional process to minimize the negative impact towards environment and human. **Assessment:** Coursework 40%, Final Examination 60%	
IBK 313 (IBK 306) Bioprocess Instrumentation and Control	2	II	Theory and criteria for equipment selection used for measurement of biological system; design of complete measurement system including signal adaptation and acquisition components. Comparison of measurement between biological and physical systems. Mathematical details and identification of biological system; interactions between biological and engineering systems; biological control system; equipment and measurement techniques in biological system. **Assessment:** Coursework 40%, Final Examination 60%	
IBK 314 (IBK 301) Downstream Process Technology	3	II	Main principles of downstream processes for bioprocess product recovery through fractionation methods, isolation and purification for production of safe and pure products. Liquid, hazardous and solid waste treatment (agro-based industry and non-agro-based industry). The suitability, efficiency and optimum yield of each process through mass and energy balance will be stressed on as well as the correct procedure to ensure a safe environment. Bioremediation, bioleaching aerobic/anaerobic treatment of waste. **Assessment:** Coursework 40%, Final Examination 60%	Dr. Rosma Ahmad 04-653 2118 rosmah@usm.my Ms. Wan Nadiah Wan Abdullah 04-653 2114 wnadiah@usm.my Dr. Liong Min Tze 04-653 2213 mintze.liong@usm.my
IEA 301 Environmental Technology Laboratory	3	I	This course exposes the students to various treatment methods for wastewater, air, solid wastes and noise pollution problems. Students also apply various theories learned from other courses. **Assessment:** Coursework 100%	Dr. Yusri Yusuf 04-653 2511 yusriy@usm.my Mr. Rizol Md. Arif 04-653 5204 rizol@usm.my

Course	Units	Sem	Description	Contact
IEG 101 Introduction to Environmental Science	3	I	This course introduces Environmental Science as a foundation to Environmental technology. Students are exposed to basic environmental chemistry and environmental microbiology including related laboratory and field work. They will be able to understand the various components of the environment and the chemistry involved in them. **Assessment:** Coursework 40%, Final Examination 60%	Assoc. Prof. Anees Ahmad 04-653 2214 aneesahmad@usm.my Dr. Norli Ismail 04-653 2824 norlii@usm.my
IEG 102 Introduction to Environmental Technology	4	II	The course is divided into four parts (including laboratory and field work) which are (i) Atmosphere – under this topic student will be introduced to environmental atmospheric science in relation to air pollution (ii) Hydrosphere – it is regarding science of hydrosphere in relation to water pollution (iii) Litosphere – science of lithosphere in relation to soil pollution (iv) Environmental problems issues – student will be introduced to pollution control, treatment and good environmental management practice. **Assessment:** Coursework 40%, Final Examination 60%	Assoc. Prof. Anees Ahmad 04-653 2214 aneesahmad@usm.my
IEK 101 Chemical Process Calculations	3	I	This course discusses the principles and calculation techniques used in chemical processes. In addition, students will be acquainted with problems of material and energy balances and the solutions to formulate and solve them. The topics taught will also assist students in learning efficiency via the introduction of methods of problem solving, definition of problems, collection of data and analyzing the collected data. This course also reviews basic principles of gas and phase behaviours, and applied physical chemistry. **Assessment:** Coursework 30%, Final Examination 70%	Assoc. Prof. Norhashimah Morad 04-653 2236 nhashima@usm.my Dr. Yusri Yusup 04-653 5201 yusriy@usm.my
IEK 105 Treatment and Management of Solid Waste	3	II	This course mainly touches on treatment and management of solid waste (municipal and scheduled waste). Solid waste characteristic, policies, collection, disposal method as well as design and operations of collecting system will be discussed accordingly. **Assessment:** Coursework 30%, Final Examination 70%	Dr. Norli Ismail 04-653 2824 norlii@usm.my
IEK 107 Thermodynamics	3	II	Thermodynamics principles: mechanical work; reversibility; First, Second and Third Laws of Thermodynamics; internal energy; enthalpy; entropy; heat capacity; free energies; properties of an ideal gas and gas mixtures; heat engine and heat pumps; Carnot cycle; equilibrium. Properties of pure substances. PVT behaviour; phase changes; phase equilibrium; Clapeyron's equation; equations of state; compressibility factor. Thermodynamics of flow processes. Steam powered plant. Internal combustion. **Assessment:** Coursework 30%, Final Examination 70%	Assoc. Prof. Anees Ahmad 04-653 2214 aneesahmad@usm.my Assoc. Prof. Norhashimah Morad 04-653 2236 nhashima@usm.my
IEK 108 Process Fluid Mechanics	3	II	Fluid statics. Basic equations of fluid flow. Flow of incompressible fluids, compressible fluids and flow past immersed bodies. Transportation and metering of fluids. Agitation and mixing processes. **Assessment:** Coursework 30%, Final Examination 70%	Prof. Teng Tjoon Tow 04-653 2215 ttteng@usm.my Dr. Yusri Yusup 04-653 5201 yusriy@usm.my

Code / Course	Units	Sem	Description	Lecturer
IEK 205 Air Pollution Control Technology	3	II	The course emphasises a study of industrial air pollution problems and abatement methods. Topics covered are: Air pollution chemistry: review effects and sources of air pollutants, combustion processes and pollutant formation Air quality management: legislation and laws, environmental sampling and monitoring, measurement at ambient and stack emission, isokinetic sampling, analysis techniques. Particulate pollutant: industrial sources and regulatory codes for particulate emissions; overview of particle/aerosol technology (particle characteristics and dynamics) ; process design of control devices: gravity settlers, cyclone, electrostatic precipitators, baghouse and scrubbers; Gaseous pollutant: Industrial sources and regulatory codes for gaseous emissions, process design of control devices: absorber, adsorber and incinerator. Sources and control of NOX, SOX, VOC's and odours. Air pollution modelling: air pollution meteorology, lapse rate, stability classes, temperature inversions, types of plume behaviour, dispersion models, gaussian plume model, plume rise, line sources and stack design. Other Air Pollution Sources: Indoor air pollution, vehicular pollution, fugitive emissions. Course work may include: Particulate and gaseous pollutants sampling work (PM10, PM2.5, SOX, NOX, CO, VOCs, landfill gases). Site visit to ASMA or industrial air monitoring station. **Assessment:** Coursework 30%, Final Examination 70%	Assoc. Prof. Mahamad Hakimi Ibrahim 04-653 2511 mhakimi@usm.my Mr. Rizol Md. Arif 04-653 5204 rizol@usm.my Dr. Yusri Yusup 04-653 5201 yusriy@usm.my
IEK 211 Equipment Design for Water Treatment	3	II	Introduction to global water requirement. Water chemistry and microbiology. Characteristics of materials found in waters. Standard for drinking water. Equipment design and unit operations such as storage, settling, coagulation, flocculation, clarification, filtration, adsorbtion, pumping station and distribution of water. Introduction to the principles and theories in separation processes, ion exchange, aeration and gas transfer. Sludge treatment: sludge characteristics, physically and chemically formed. Dewatering and sludge recovery. Final disposal of sludge. **Assessment:** Coursework 30%, Final Examination 70%	Prof. Mohd. Omar Abd Kadir 04-653 5206 akmomar@usm.my Dr. Norli Ismail 04-653 2824 norlii@usm.my
IEK 212 Process Heat Transfer	3	I	Fundamental principles of heat transmission by conduction, convection, radiation, and evaporation. Applications of these principles to the solution of industrial heat transfer problems and to the design calculations for heat exchange situations **Assessment:** Coursework 30%, Final Examination 70%	Prof. Teng Tjoon Tow 04-653 2215 ttteng@usm.my
IEK 213 Mass Transfer and Separation Processes	3	II	Mass transfer. Principles of diffusion. Separation processes: distillation, gas absorbtion, humidification, drying, centrifugation, filtration and extraction. **Assessment:** Coursework 30%, Final Examination 70%	Prof. Teng Tjoon Tow 04-653 2215 ttteng@usm.my
IEK 215 Environmental, Safety and Health Legislation	3	II	In this course the students are acquainted to concept of managing the environment via legislation. The two main legislations discussed are the Environmental Quality Act 1974 and the Occupational Safety and Health Act 1994. For both legislations, the topics cover the principal act, along with its related Regulations and Orders. This course uses a problem based learning approach where students are exposed to different scenarios using newspapers clippings of various industrial accidents. **Assessment:** Coursework 40%, Final Examination 60%	Ms. Fera Fizani Ahmad Fizri 04-653 2110 fera@usm.my Mr. Rizol Md. Arif 04-653 5204 rizol@usm.my

| IEA 216 (IEK 216) Computer Applications in Industry | 3 | I | The course emphasizes on the introduction of computer application in environmental technology. It has two parts, viz; Autocad and Matlab.

In AutoCAD, students will be exposed to the use of AutoCAD in preparing necessary drawing for government authority approval. They need to integrate relevant unit operations and chemical process calculation, which takes into account the main objective of preparing the required drawings. Examples on preparing isometric drawing on piping layout will also be introduced.

Matlab emphasizes on the use of mathematical notation in computer programming as part of solving methods to some environmental technology problems such as an iteration of terminal settling velocity for settling basin, plume distribution of an air stack and vibration of a beam. Students will be introduced to the simple modelling of environmental problems and how computer simulation helps to a deep understanding of the focused phenomena.

Assessment:
Coursework 100% | Assoc. Prof. Anees Ahmad
04-653 2214
aneesahmad@usm.my |
| IEK 306 Treatment and Management of Scheduled Waste | 3 | I | This course covers treatment and management of scheduled waste according to legislation as well as common practices in other countries. Scheduled wastes as those generated from various industries. The management topic covers from the beginning of a process until disposal. The different categories wastes will be elaborated and the principles that are involved in "Cleaner production" and "Cleaner Technology" will be taught. Pollution prevention and minimization will also be discussed. Various techniques of waste disposal will be included. Suitable examples from local and overseas sources will be part of the discussion materials.

Assessment:
Coursework 40%,
Final Examination 60% | Ms. Fera Fizani Ahmad Fizri
04-653 2110
fera@usm.my

Assoc. Prof. Norhashimah Morad
04-653 2236
nhashima@usm.my

Dr. Norli Ismail
04-653 2824
norlii@usm.my |
| IEK 307 Noise and Vibration Control Technology | 3 | I | Introduction to the effect of noise, sound and vibration to humans. Basic concept in reduction and generation of noise, sound and vibration,; control methods; materials for reduction and control; related legislations; design, instrumentations, measurement, detection and reduction of noise, sound and vibrations.

Assessment:
Coursework 30%,
Final Examination 70% | Prof. Mohd. Omar Abd. Kadir
04-653 5206
akmomar@usm.my |
| IEK 308 Industrial Wastewater Treatment Plant Design | 3 | I | The course covers basic treatment, objectives and design methodology, understanding of basic physical, chemical and biological unit operations, design of treatment plant facilities, final disposal, cost analysis, optimum and economic designs. Students will be exposed to project-based treatment plant design work. They need to integrate relevant unit operations taking into account the main objective of meeting current environmental standards.

Assessment:
Coursework 50%,
Final Examination 50% | Prof. Mohd. Omar Abd. Kadir
04-653 5206
akmomar@usm.my

Dr. Norli Ismail
04-653 2824
norlii@usm.my |
| IEK 309 Chemodynamics | 3 | II | Chemodynamics is a study of the transport and fate of chemical substances within the three environmental geospheres: water, air and earthen solids. Course objectives are to introduce and evaluate current methods or models for materials transport from an environmental entry site to the various geospheres so that environmental exposure can be estimated.

Assessment:
Coursework 30%,
Final Examination 70% | Prof. Mohd. Omar Abd. Kadir
04-653 5206
akmomar@usm.my |

IEA 312 (IEK 312) Society and Environment Project	3	I	The course is based on proactive involvement in environmental social service projects while academically examining and rethinking societal systems and its relationship with environmental problems created by the exploitation of natural resources and the generation of waste by industrial society. The link between societal systems and the environment is made through an appreciation of environmental history and philosophy, environmental political-economy, as well as through understanding the connection between science and technology, culture and religions to the environment. **Assessment:** Coursework 100%	Assoc. Prof. Mahamad Hakimi Ibrahim 04-653 2511 mhakimi@usm.my
IEK 314 Environmental Audit	3	I	Students will be exposed to the basis of environmental auditing principals including system audit, field work and laboratory auditing. Students will learn planning methods, preparation and how to carry out an environmental auditing. Students will also learn on how to prepare an audit report. Evaluation on auditing effectiveness will also be discussed. Real life examples and experiences will be highlighted to enhance understanding on the relatively new subject matter. **Assessment:** Coursework 40%, Final Examination 60%	Ms. Fera Fizani Ahmad Fizri 04-653 2110 fera@usm.my
IEK 317 Environmental Management	3	II	Students will be exposed to the planning, implementation and management of the environment which are highly developed in industries. Besides being given enough local scenario information, students will also be exposed to the development of Environmental Management System according to the required international standard, ISO 14001, Environmental Impact Assessment (EIA) and Environmental Management Plan (EMP). Environmental Performance Evaluation (EPE), Environmental Labeling (EL) and Life Cycle Assessment (LCA) and how each is linked to the other in the overall effort to manage the environment will also be covered. **Assessment:** Coursework 40%, Final Examination 60%	Assoc. Prof. Norhashimah Morad 04-653 2236 nhashima@usm.my Ms. Fera Fizani Ahmad Fizri 04-653 2110 fera@usm.my
IKA 301 Unit Operations Laboratory	2	II	Laboratory work based on Chemical Process Unit Operations theory taught in IEK 108 (Process Fluid Mechanics), IEK 212 (Process Heat Transfer) and IEK 213 (Mass Transfer and Separation Processes). **Assessment:** Coursework 100%	Dr. Yusri Yusuf 04-653 2511 yusriy@usm.my Mr. Rizol Md. Arif 04-653 5204 rizol@usm.my
IMA 312 Food Processing Practical	2	I	This subject is divided into several experiments and students will be able to try different processing practical and gain valuable hands-on exposure on food processing technologies. The practical provide hands-on exposure on food processing technology covered in IMK 309 (Food Processing Technology). This will assist understanding of theories taught in this course. **Assessment:** Coursework 100%	Prof. Azhar Mat Easa 04-653 5207 azhar@usm.my Dr. Cheng Lai Hoong 04-653 5209 lhcheng@usm.my Dr. Nurul Huda 04-653 2112 nrlhd@usm.my Assoc. Prof. Noryati Ismail 04-653 2220 noryati@usm.my

Course	Units	Sem	Description	Lecturer
IMA 313 Food Preservation Practical	2	I	The practical labs will be based on subject matter covered in the lectures. In the end of the course, factory visits will be organized. **Assessment:** Coursework 100%	Prof. Azhar Mat Easa 04-653 5207 azhar@usm.my Dr. Cheng Lai Hoong 04-653 5209 lhcheng@usm.my Dr. Fazilah Ariffin 04-653 5208 fazilah@usm.my
IMG 103 Food Chemistry	3	II	An integrated lecture/lab course in food chemistry. The lecture portion of the course focuses on the theoretical basis of common food phenomena related to the macrocomponents (water, protein, carbohydrates and lipids) and microcomponents (vitamin, mineral and pigment) of foods. The laboratory components provide opportunities for students to manipulate food/model system to gain a better understanding of the reactivity and related functional properties of food components. **Assesment:** Coursework 30%, Final Examination 70%	Assoc. Prof. Norziah Mohd. Hani 04-653 2222 norziah@usm.my Dr. Fazilah Ariffin 04-653 5208 fazilah@usm.my Dr. Rabeta Mohd. Salleh 04-653 5211 rabeta@usm.my Dr. Cheng Lai Hoong 04-653 5209 lhcheng@usm.my Dr. Nurul Huda 04-653 2112 nrlhd@usm.my
IMK 103 Introduction to Food Science and Technology	2	I	This course introduces new students to the field of food science and technology. The course will cover the historically important discoveries in food science and technology; food groups and it nutritive role, food spoilage and the preservation methods and food product fabrication; quality assurance and food laws; current developments and careers. **Assessment:** Coursework 30%, Final Examination 70%	Prof. Gulam Rusul Rahmat Ali 04-653 2216 gulam@usm.my
IMK 104 Nutrition	3	II	This course is an introductory to the study of human nutrition. Nutrients are studied relative to their function in metabolism, sources in food, and relationship to health. The challenge will be to learn how to evaluate the nutrition facts as consumers of nutrition information. **Assessment:** Coursework 40%, Final Examination 60%	Dr. Rabeta Mohd. Salleh 04-653 5211 rabeta@usm.my

IMK 105 Biochemistry	2	I	This course describes the biochemical features of cell biology. This course is organized into four parts. This is intended to provide students with a thorough grounding biochemistry to follow subsequent learning. An introductory section reviews the structure and functions of cells and organelles, and acid-base chemistry. Section II focuses on gene expression and replication. Among the topics covered are nucleic acid structures, DNA replication, transcription and translation. Section III covers various aspect of enzyme including its kinetics, inhibition and regulation. The last section covers cell bioenergetics. The major topics covers are glucose catabolism, glycogen metabolism, glyconeogenesis, citric acid cycle, lipid metabolism and amino acid metabolism. **Assessment:** Coursework 30%, Final Examination 70%	Dr. Rabeta Mohd. Salleh 04-653 5211 rabeta@usm.my
IMG 203 Chemical Analysis of Food	3	I	Description on the theory and practice of the chemical analysis of food components, including their chemical separation, identification and quantification and characterization using classical and modern instrumental food analysis techniques. To give a thorough understanding of modern methods of food composition analysis, including classical and instrumental chemical analysis of food, and to give practical experience of relevant procedures. **Assessment:** Coursework 30%, Final Examination 70%	Assoc. Prof. Norziah Mohd. Hani 04-653 2222 norziah@usm.my Dr. Fazilah Ariffin 04-653 5208 fazilah@usm.my
IMG 204 Instrumental Analysis of Food	3	II	Spectrochemical analysis methods that use absorption of electromagnetic radiation (ultraviolet spectroscopy, visible spectroscopy, molecular fluorescence, infrared spectroscopy, nuclear magnetic resonance spectroscopy, atomic absorption/emission spectroscopy) will be discussed. Other instrumental methods such as polarimetry, thermal analysis, electrophoresis and chromatographic methods (HPLC and GC) are also given. In all instrumental methods, aspects of instrumentation components, practical consideration of methods for qualitative and quantitative analysis such sample preparation and sources of error are discussed. Various aspects of methodology and application of quantitative and qualitative analysis used in the instrumental examination of food products are discussed. **Assessment:** Coursework 30%, Final Examination 70%	Assoc. Prof. Norziah Mohd. Hani 04-653 2222 norziah@usm.my Dr. Cheng Lai Hoong 04-653 5209 lhcheng@usm.my
IMG 211 Food Microbiology I	3	I	Microbiology is the science, which includes the study of the occurrence and significance of bacteria, fungi, protozoa, and algae, which are the beginning, and ending of intricate food chains upon which all life depends. This course comprises of 2 unit of basic microbiology lectures, reinforced with an equivalent of one unit of laboratory work on related topics. **Assessment:** Coursework 30%, Final Examination 70%	Prof. Gulam Rusul Rahmat Ali 04-653 2216 gulam@usm.my Dr. Rajeev Bhat 04-653 5212 rajeev@usm.my
IMG 222 Food Microbiology II	3	II	The Food Microbiology II course will cover the aspects of microorganisms in food in terms of the factors affecting their growth in food as well as the manifestations including food spoilage and foodborne diseases. Students will also be taught on the microbiological criteria for food and methods of evaluating microbiological food quality and food safety. Emphasis will also be given on the principles and techniques of sampling and analysis, as well as standard methods normally used in the field of food microbiology. **Assessment:** Coursework 40%, Final Examination 60%	Prof. Gulam Rusul Rahmat Ali 04-653 2216 gulam@usm.my Dr. Rajeev Bhat 04-653 5212 rajeev@usm.my

IMG 315 Food Biotechnology	4	I	This course comprises of one unit of molecular biology, and one and a half units of fermentation technology and half a unit of enzyme technology lectures, reinforced with an equivalent of one unit of laboratory work on related topics. The course will give basic knowledge on gene cloning and techniques used to study the cloned gene. The course will also introduce the aspects involved in fermentation technology, covering characteristics and principles of microbial growth as well as fermentation parameters including temperature, pH, aeration and agitation. Other aspects covered include concept and methods of sterilization, and modes of fermentation (batch, continuous, fed-batch, solid state). The part on Enzyme Technology will discuss protein purification including measurement of activity and degree of purification, handling of enzymes and their application in the food industry. **Assessment:** Coursework 30%, Final Examination 70%	Assoc. Prof. Norziah Mohd. Hani 04-653 2222 norziah@usm.my Dr. Rosma Ahmad 04-653 2218 rosmah@usm.my Ms. Wan Nadiah Wan Abdullah 04-653 2113 wnadiah@usm.my
IMG 405 Food Packaging	3	I	The course is designed to help students identify and consider major requirements of packages for a range of food products that require shelf life extension. The key focus in this subject is on knowledge and application of the properties of commonly used packaging materials such as paper, plastic, metal and glass. The physical and chemical properties of these food packaging materials are studied in relation to their use in food-packaging applications. This coupled with an understanding of the compatability requirements of food products and container which form the basic for the choice and selection of packaging material for a specific product. Modern food packaging practices related to meats, beverages, fruits, vegetables, bakery products, and snack foods will also be covered in this course. **Assessment:** Coursework 30%, Final Examination 70%	Assoc. Prof. Noor Aziah Abd. Aziz 04-653 2223 naziah@usm.my Dr. Fazilah Ariffin 04-653 5208 fazilah@usm.my
IMG 411 Quality Management of Food and Sensory Evaluation	4	I	This course will highlight to the students about Food Laws and Legislation including provisions for the import and export of Malaysian products. They will also be exposed to total quality management system (QMS) involving TQM, ISO 9001:2000, ISO 14000 and Halal. For interpretation of quality control data, statistical process control (SPC) will be required. Methods of product quality control over incoming raw materials, during preparation, over packaging materials and process, and processing procedures will be illustrated. Quality evaluation methods including sensory evaluation, physical testing such as textural properties and colour evaluation, chemical and microbiological will be illustrated. Product shelf life, market review and consumer complaints will be dealt with which will include consumer evaluation, product development, sanitation requirements and waste management. **Assessment:** Coursework 30%, Final Examination 70%	Assoc. Prof. Noryati Ismail 04-653 2220 noryati@usm.my Dr. Nurul Huda 04-653 2112 nrlhd@usm.my
IMK 202 Food Commodity	3	I	This course covers both the major plant and animal commodities used in food processing. Commodities from plant origin include fruits and vegetables, legumes, field crops (coffee, tea and cocoa), cereals, herbs and spices. Commodities from animal origin include meat, fish, poultry, eggs, and milk. **Assessment:** Coursework 30%, Final Examination 70%	Dr. Rabeta Mohd. Salleh 04-653 5211 rabeta@usm.my Dr. Nurul Huda 04-653 2112 nrlhd@usm.my
IMK 209 Physical Properties of Food	2	I	This course covers the study of the principles and measurement of various physical properties of foods that are important in handling, preparing, processing, preserving, packaging, storing and distribution of foods. The application of the underlying physical principles in food formulation and production will also be discussed. **Assessment:** Coursework 30%, Final Examination 70%	Prof. Abd. Karim Alias 04-653 2268 akarim@usm.my

IMK 212 Management of Halal Food	2	I	This course begins with introduction of Islam, Quran and all aspects regarding halal as ordained by God in order to deliberate on Halal and haram. This will emphasise that without fail Muslims must be provided with halal food. Then the principles of halal food will be explained in order to deliberate that halal food is the requirements of all Muslims. Halal food sources will illustrate what are haram and halal. This includes Islamic slaughtering practices, hygienic and sanitary food preparation and food production involving methodology, componets, ingredients and additives which are halal. This includes other aspects such as packaging, storage and transportation. In order to prepare and assure halal production in the factory local and foreign food laws and regulations including Halal Standard MS 1500:2000, Food Act 1983, Codex Alimentarius, HACCP, GMP, Quality maagementsystems such as ISO 9001:2000 and ISO 22000 must be understood. To measure the success of implementation of halal in the industry, halal certification must be subscribed. This requires the implementation of a proper halal management system in the food and beverage manufacturing plants. **Assessment:** Coursework 40%, Final Examination 60%	Assoc. Prof. Noryati Ismail 04-653 2220 noryati@usm.my Dr. Tajul Aris Yang 04-653 5210 taris@usm.my
IMK 221 Food Ingredient	3	I	This course covers the different groups of selected food ingredients commonly used in food products. Classification, physicochemical and functional characteristics and application of each group of ingredient will be discussed. **Assessment:** Coursework 30%, Final Examination 70%	Prof. Abd. Karim Alias 04-653 2268 akarim@usm.my Assoc. Prof. Noryati Ismail 04-653 2220 noryati@usm.my
IMK 308 Food Preservation Principles	4	I	The principles of food preservation will be emphasized. Major topics covered will be the fundamentals of water activity, food dehydration, intermediate moisture foods, fundamentals of heat treatment, pasteurization, sterilization, canning processing and aseptic processing, application of low temperature treatment, fermentation process, use of chemical additives, irradiation and the application of hurdle concept in various foods. **Assessment:** Coursework 30%, Final Examination 70%	Prof. Azhar Mat Easa 04-653 5207 azhar@usm.my Dr. Cheng Lai Hoong 04-653 5209 fazilah@usm.my Dr. Fazilah Ariffin 04-653 5208 lhcheng@usm.my

IMK 309 Food Processing Technology	4	I	This course discuss the basic food processing techniques and associated technologies as applied to the manufacture of commercial food products. Processing effects on aesthetic and nutritional food quality of plant and animal products will be explored. **Assessment:** Coursework 30%, Final Examination 70%	Prof. Azhar Mat Easa 04-653 5207 azhar@usm.my Dr. Cheng Lai Hoong 04-653 5209 lhcheng@usm.my Dr. Nurul Huda 04-653 2112 nrlhd@usm.my Assoc. Prof. Noor Aziah Abd. Aziz 04-653 2223 naziah@usm.my
IMK 404 Food Product Development	3	I	Company growth and even survival depends on the introduction of successful new products into old and new markets. The dividing line between product success and failure depends on many factors, but the most important are new product qualities, skills and resources of the company, market, and marketing proficiency, and an organized product development process. There is a need to understand consumers' behaviour and attitudes and to be able to design a product to meet the users' need. But it is also necessary to have the technological knowledge and the skills, and the organizational ability to bring a product to a successful commercial conclusion in the marketplace. This course covers some of these key issues in product development and outlines the methods of managing them. Group of students will have to develop a food product, present and report the progress of the product development and exhibit the product for public viewing. **Assessment:** Coursework 30%, Final Examination 70%	Assoc. Prof. Noor Aziah Abd. Aziz 04-653 2223 naziah@usm.my
IMK 407 Food Safety	3	II	The course focuses on chemical and microbiological food safety, emerging problems(such as novel foods, food sensitivities, food toxicants) health hazards, awareness of common sanitation concerns within the food processing plant and food issues. Provide knowledge and understanding of the importance of producing safe food through the identification of food safety hazards, control and monitoring procedures and appropriate corrective actions, thus contributing to and encouraging improvements in food safety practice. The issue of regulation is highlighted by the integration of scientific knowledge into the decision making process, the impact of regulations on economics and the role of various sectors in the process. The food safety control focus on how the control is carried out in practice and how enforcement measures can be implemented. **Assessment:** Coursework 30%, Final Examination 70%	Prof. Gulam Rusul Rahmat Ali 04-653 2216 gulam@usm.my
IMK 421 Primary Products Technology	2	I	This course covers an in-depth the study of the chemistry and technology of two important commodities in Malaysia, i.e., starch (with emphasis on sago starch) and commercial fats and oils (with emphasis on palm oil). The application of the underlying principles in food formulation and production will also be discussed. **Assessment:** Coursework 30%, Final Examination 70%	Prof. Abd. Karim Alias 04-6532268 akarim@usm.my

IUK 107 Chemistry for Technologist	4	I	This course deals with principles of chemistry specifically addressed to the needs of courses in coatings, adhesives, and paints technologies. the spectroscopic methods such as FT-IR and 1H-NMR will be dealt with a view to characterizing fuctional groups and establishing structures of molecules of relevance to the technologies mentioned above. Lectures will include specific examples from bioresource, adhesives, surface coatings and etc. **Assessment:** Coursework 30%, Final Examination 70%	Dr. Issam Ahmed Mohammed 04-653 2203 issam@usm.my
IUK 108 Statistics with Computer Application	4	I	Describing, Exploring, and Comparing Data: Frequency distribution, Measures of center, Measures of variation, Measures of relative standing. Probability: Fundamental, Addition rule, Multiplication rule, complements and conditional probability, probability distribution, Random variables, Binomial probability distribution, Poisson distribution, Normal distribution, Standard normal distribution, Sampling distribution and estimators, Central limit theorem. Estimates and sample size: Estimating a population proportion, Estimating a population mean, Estimating a population variance. Hypothesis Testing: Basic hypothesis testing, Testing a claim about a proportion, Testing a claim about a mean, Testing a claim about a standard deviation or variance. Inferences from two samples: Inferences about two proportions, Inferences about two means, Inferences from matched pairs, comparing variation in two samples. Correlation and regression: Correlation, regression, Variation and prediction intervals, modeling. Analysis of variance: One- way ANOVA, two-way ANOVA. Nonparametric Statistics: Sign test, Wilcoxon signed-ranks test for matched pairs, Wilcoxon rank-sum test for two independent samples, Kruskal-Walis test, rank correlation. Statistical process Control: control charts for variation and mean, control charts for Attributes. Describing, Exploring, and Comparing Data: Frequency distribution, Measures of center, Measures of variation, Measures of relative standing. Probability: Fundamental, Addition rule, Multiplication rule, complements and conditional probability, probability distribution, Random variables, Binomial probability distribution, Poisson distribution, Normal distribution, Standard normal distribution, Sampling distribution and estimators, Central limit theorem. Estimates and sample size: Estimating a population proportion, Estimating a population mean, Estimating a population variance. Hypothesis Testing: Basic hypothesis testing, Testing a claim about a proportion, Testing a claim about a mean, Testing a claim about a standard deviation or variance. Inferences from two samples: Inferences about two proportions, Inferences about two means, Inferences from matched pairs, comparing variation in two samples. Correlation and regression: Correlation, regression, Variation and prediction intervals, modeling. Analysis of variance: One- way ANOVA, two-way ANOVA. Nonparametric Statistics: Sign test, Wilcoxon signed-ranks test for matched pairs, Wilcoxon rank-sum test for two independent samples, Kruskal-Walis test, rank correlation. Statistical process Control: control charts for variation and mean, control charts for Attributes. **Assessment:** Coursework 30%, Final Examination 70%	Dr. Abbas Fadhl Mubarek Al-Karkhi 04-653 5203 abbas@usm.my

IUK 191 Mathematics	4	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 use of Gauss and Cramer methods. **Assessment:** Coursework 30%, Final Examination 70%	Ms. Nor Azimah Idris 04-653 5202
IUK 208 Experimental Design with Computer Applications	3	II	Introduction, Replication, Randomization, Blocking, Definitions (Experiment, Treatment, Factor, Level, Experimental unit, Experimental design, Random, Replicate). Completely Randomized Design: Randomization, Analysis of variance, equal replication and unequal replication, Estimation of the model Parameters, Comparison of Individual Treatment Means: Comparing of pair Treatment Means, Comparing with a control, orthogonal contrast. Randomized Block Design: blocking, Randomized block design, Model and Assumptions, Missing values, Relative efficiency. Latin Square design Incomplete Block design: balanced incomplete block designs, Partially Balanced incomplete block designs. Factorial Experiments (Designs): General factorial experiments, 2^k Factorial experiment, 3^k factorial experiment, Confounding, regression analysis, Response surface: Method of steepest ascent, Analysis of second-order model, Location of stationary point, Designs for fitting the first-Order and second-order models. Mixture experiments. **Assessment:** Coursework 30%, Final Examination 70%	Dr. Abbas Fadhl Mubarek Al-Karkhi 04-653 5203 abbas@usm.my
IUK 291 Mathematics II	4	II	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 and Fourier series are taught with a view to examine the theory and properties of certain functions that can represented as sums of series. **Assessment:** Coursework 30%, Final Examination 70%	Ms. Nor Azimah Idris 04-653 5202
IUK 303 Industrial Waste Management	3	II	Introduction on solid waste management system. Solid waste management planning. Sources, types and composition of solid waste. Accumulation, handling, processing and storage of solid and harmful waste. Principles of water quality management. Sources and consequences of waste water pollution. Introduction to techniques of waste water processing. **Assessment:** Coursework 30%, Final Examination 70%	Dr. Arniza Ghazali 04-653 5210 / 2239 arniza@usm.my
IUK 304 Industrial Quality Management	3	II	Techniques to improve the productivity of industries through the development and upgrading of quality management system. Typically, this course is offered in semester II, however students are advised to get further information before registering this course. **Assessment:** Coursework 30%, Final Examination 70%	Prof. Azhar Mat Easa 04-653 5207 azhar@usm.my Dr. Abbas Fadhl Mubarek Al-Karkhi 04-653 5203 abbas@usm.my

Course	Units	Sem	Description	Contact
IWK 100 Bioresource as Industrial Raw Materials	2	I	This course introduces students to the various types of lignocellulose materials. Main resources of raw materials from the forest will be discussed. This include different types of forest, introduction to logging activity, production of solid wood, distribution, production method and properties of commercial wood and non-wood in Malaysia. Benefits to economy, national and international trade will also being discussed. The potential of Lignocellulose as a source of energy will be introduced. Emphasize 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. **Assessment:** Coursework 30%, Final Examination 70%	Assoc. Prof. Abdul Khalil H.P. Shawkataly 04-653 2200 akhalil@usm.my Assoc. Prof. Rokiah Hashim 04-653 5217 hrokiah@usm.my
IWK 102 Principles of Bioresource Science and Technology	4	I	Structure and organization of wood anatomy – fibre, vessel, parencyma. Wood cell ultrastructure – cell wall organization, 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. **Assesment:** Coursework 30%, Final Examination 70%	Assoc. Prof. Othman Sulaiman 04-653 2260 othman@usm.my
IWA 281 Coatings Technology Laboratory I	2	I	This 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. **Assesment:** Coursework 100%	Assoc. Prof. Poh Beng Teik 04-653 2202 btpoh@usm.my Dr. Tay Guan Seng 04-653 2201 taygs@usm.my
IWA 282 Bioresource Technology Laboratory I	2	I	This is a practical course involving student to understand the followings: a. Anatomical structure of wood b. Physical properties of wood - Moisture content, density and movement in wood. c. Preservation of wood d. Wood strength e. Chemical properties **Assesment:** Coursework 100%	Assoc. Prof. Othman Sulaiman 04-653 2260 othman@usm.my
IWA 283 Paper Technology Laboratory I	2	II	This practical course must be taken by the student followed IWK 103/4 course. The Student will be exposed to the different type of pulping methods, pulp beating, handsheet papermaking and pulp and paper properties testing. **Assessment:** Coursework 100%	Dr. Mazlan Ibrahim 04-653 2204 maz@usm.my
IWA 381 Coatings Technology Laboratory II	2	II	This is a practical course related to synthesis of raw materials, 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. **Assessment:** Coursework 100%	Assoc. Prof. Poh Beng Teik 04-653 2202 btpoh@usm.my Dr. Issam Ahmed Mohamed 04-653 2203 issam@usm.my

Code / Course	Units	Sem	Description	Contact
IWA 382 Bioresource Technology Laboratory II	2	I	This practical course is dealing with thermoset and thermoplastic resin analysis and chemical modification of lignocellulosic material. In addition, student will be exposed to particleboard and fibreboard manufacturing. **Assessment:** Coursework 100%	Assoc. Prof. Abdul Khalil H.P. Shawkataly 04-653 2200 akhalil@usm.my
IWA 383 Paper Technology Laboratory II	2	I	This course will expose the students to the bleaching process and all the calculations and analyses involved, measurement of paper properties, determination of additive content in commercial paper and paper recycling. The experiments involved are bleaching of pulp, determination of pulp and paper properties, determination of various types of commercial papers properties and starch content, and recycling of various type of paper. **Assessment:** Coursework 100%	Dr. Leh Cheu Peng 04-653 2147 cpleh@usm.my
IWK 101 Principles of Coatings Technology	4	II	Introduction to polymer science, chemistry of addition polymerization using free radical, ionic initiators and others; chemistry of condensation polymerization; chemistry of co-polymerization; addition and condensation polymers. Polymerization methods in industry; bulk, solution, emulsion, suspension and etc. Polymer solution rheology and dispersion rheology: basic concept, rheology parameter measurement, basic concept in polymer structure and behaviour of crystalline, amorphous and semi-crystalline polymers. Polymer characterization: Molecular weight, molecular weight calculation, basic analysis of FTIR, UV, NMR, volumetric method, etc. **Assessment:** Coursework 30%, Final Examination 70%	Prof. Rozman Hj. Din 04-653 2219 rozman@usm.my
IWK 103 Pulp Production and Paper Recycling	4	II	This course provides a full description on the various types of pulp processes and the raw materials convertible to pulp. The raw materials encompass both wood and non-wood, with emphasis given to non-wood, in line with the present global research trend and strife to adhere to the green industrial practices. Also in conjunction with the green practices, focus is placed on the emerging new hybrid pulping techniques, which is economic and environmentally friendly. As for part 1 of this course, students are also assigned to study the success of a paper manufacturer in China who had made himself a millionaire and analyse the feasibility of adopting the same practice and technology in Malaysia. This is aimed at exposing them to the manufacturing activity and the cash flow involved in the real paper business. **Assessment:** Coursework 30%, Final Examination 70%	Dr. Arniza Ghazali 04-653 2239 arniza@usm.my Dr. Leh Cheu Peng 04-653 2147 cpleh@usm.my
IWK 105 Bioresource Based Products	4	II	This course teaches students the wood composites technology and chemical technology. Wood composites technology comprise of efficiency of the wood composites compared to solid wood. Students will be exposed to plywood production technology, particleboard, fibreboard, laminated veneer lumber, oriented strand board and others – their properties, processing and applications. The chemical technology will covers chemicals from trees and lignocellulose; thermal modification, charcoal, gases, hydrothermal modification, chemical modification. **Assessment:** Coursework 30%, Final Examination 70%	Assoc. Prof. Baharin Azahari 04-653 5215 baharin@usm.my
IWK 201 Raw Materials and Coatings Chemistry	4	I	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. **Assessment:** Coursework 30%, Final Examination 70%	Assoc. Prof. Poh Beng Teik 04-653 2202 btpoh@usm.my Assoc. Prof. Baharin Azahari 04-653 5215 baharin@usm.my

IWK 203 Stock Preparation and Papermaking	4	I	This course covers 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, calendering, reeling and winding processes. **Assessment:** Coursework 30%, Final Examination 70%	Dr. Mazlan Ibrahim 04-653 2204 maz@usm.my
IWK 204 Bioresource, Paper and Coatings Product Development	3	II	In this course the steps involved in products development will be discussed. The focus will be given on the products design. Students will be exposed to various types of material, material properties, and processing techniques that are used in making products. Technique of selecting the right material and processing for a given product will also be covered. Students are also taught on the structural design to improve the performance of a product. **Assessment:** Coursework 40%, Final Examination 60%	Assoc. Prof. Baharin Azahari 04-653 5215 baharin@usm.my
IWK 205 Cemical Additives and Paper Properties	3	II	This course entails the basic properties of fibre such as fibre length, coarseness, swelling, thickness and intrinsic strength and the importance of fibre properties in papermaking; Analyses of paper properties by discussing on theories and techniques of paper properties measurement including analyses of structural properties, mechanical strength testing, stress and strain relationship, the basis of colour measurement and light transmittance; Besides, this course also discussed various additives that are used in the paper industry: sizing agents, dry and wet strength additives, fillers, retention aids, surface sizing, dyes and pigments and brightening agents. **Assessment:** Coursework 30%, Final Examination 70%	Dr. Leh Cheu Peng 04-653 2147 cpleh@usm.my
IWK 301 Coatings Process and Equipments	3	I	Paint manufacture – Premixing, grinding and finishing. Grinding equipment, fineness measurement and Daniel Flow Point method. Pigment Volume Concentration and its relationship to paint properties. Paint testing. Corrosion. Surface preparation. Paint formulation. Burrell solvency principles. Alkyd resin technology – the importance of alkyd in the coatings industry, alkyd calculations and design. Printing ink – Introduction, types of inks, manufacture of ink and properties. Colour technology – Colour and the human eye, additive and subtractive colour mixing. Colour systems – Munsell, Ostwald and CIE colour systems, Kubelka-Munk equation. Colour measurement and matching. **Assessment:** Coursework 30%, Final Examination 70%	Assoc. Prof. Issam Ahmed Mohamed Al-Salihy 04-653 2203 issam@usm.my
IWK 302 Wood Engineering	3	II	This course focuses on topics of wood and biocomposites strength, mechanical testings 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. In addition, the basic concepts of finite element method and its application to discrete structures will also be covered. **Assessment:** Coursework 30%, Final Examination 70%	Dr. Tay Guan Seng 04-653 2201 taygs@usm.my

IWK 304 Furniture Manufacturing	3	I	This course teaches the basic knowldege that is related to the production of furniture in theory and practical. 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 production. **Assessment:** Coursework 30%, Final Examination 70%	👤 Assoc. Prof. Rokiah Hashim 📞 04-653 5217 🖱 hrokiah@usm.my
IWK 305 Advanced Technology of Coatings	2	II	This is a course which 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, ultraviolet (UV) and electron beam (EB) radiation curing. The students are familiarized with the materials and applications for each coating technology. **Assessment:** Coursework 30%, Final Examination 70%	👤 Dr. Tay Guan Seng 📞 04-653 2201 🖱 taygs@usm.my 👤 Assoc. Prof. Poh Beng Teik 📞 04-653 2202 🖱 btpoh@usm.my
IWK 306 Fibres and Lignocellulosic Composites	2	II	Types of lignocellulosic fibres from agriculture waste (paddy), estate (oil palm, cocoa, pineapple) and non-wood products like rattan, bamboo, and others. Importance of long and short fibres, fibre strength, chemical composition of fibres and ultrastructure. Natural adhesive source from lignocellulosic like tannin, lignin, furfural alcohol, biopol, starch modification and others. Importance of fibre and matrix compatibility as the basis of composite technology. Production of conventional composite (organic and inorganic) from sources other than wood to produce particleboard, fibreboard, insulation board, cement and gypsum concrete and others. Use of fibre and ligncellulosic fillers in thermoset and thermoplastics and production processes like compression, injection, extrusion and others. Physical, mechanical and environmental testings besides recovery and combination principles of various fibres in composite. **Assessment:** Coursework 30%, Final Examination 70%	👤 Dr. Tay Guan Seng 📞 04-653 2201 🖱 taygs@usm.my 👤 Assoc. Prof. Abdul Khalil H.P. Shawkataly 📞 04-653 2202 🖱 akhalil@usm.my
IWK 307 Advanced Paper Technology - Instrumental Analysis for Pulp and Paper	2	I	This course describes the application of instrumental techniques of analysis to pulp, paper, lignocellulosics as the precursor materials in the pulp production and liquor as the side product in a pulping process. Emphasis is placed on the interpretation of output and the way to solve problems by applying multiple techniques of analysis. Students are exposed to the current techniques of analysis published in journals and the net to help them gain insights into the live-application of instrumental techniques of analysis to pulp and paper industry. **Assessment:** Coursework 30%, Final Examination 70%	👤 Dr. Arniza Ghazali 📞 04-653 2239 🖱 arniza@usm.my

Course Code/ Title	Unit	Semester Offered	Synopsis	Details of Lecturer
LKM 100 Bahasa Malaysia I	2	I & II	This course is specially designed to be a simple introduction to the learning of Bahasa Malaysia by foreign students, graduate students, non-graduating students and foreign contract staff. It is offered every semester over 14 weeks with 4 contact hours per week. The course covers the four language skills – listening, speaking, reading and writing. The first two skills are integrated in the oral component of the course whereas the other two skills are dealt with in the writing component. At the end of the course, students should be able to speak, read and write simple Bahasa Malaysia in daily situations. **Assessment:** Coursework 50%, Final Examination 50%	Ms. Mariyani Mahamud 04-653 4123 mariyani@usm.my
LMT 100 Preparatory English	2	I & II	At the end of the course, students will be able to: (a) understand proverbs, idioms, clichés, similes; (b) interpret short texts (e.g. poems); (c) skim and scan texts a variety of texts; (d) analyse short texts for overall themes, main ideas and supporting details; (e) identify and use basic parts of speech and tenses; (f) read literary and narrative texts and identify basic elements such as character, plot, style, technique and theme; (g) deliver simple presentations on a prepared topic based on short stories; and write essays of about 250 words. **Assessment:** Coursework 50%, Final Examination 50%	Mr. Lye Mun Cheong 04-653 3997 mclye@usm.my
LSP 300 Academic English	2	I & II	The emphasis of this course is on giving students a strong foundation in English as a means of acquiring knowledge in their disciplines and to equip them with the necessary language skills to train and work in. Apart from developing their ability to handle basic language concepts, this course also exposes students to the appropriate language concepts as well as critical thinking skills. An integrated approach will be adopted to improve students' reading comprehension, listening, writing as well as speaking skills. **Assessment:** Coursework 50%, Final Examination 50%	Ms. Yeap Mei Chan 04-653 3403 mcyeap@usm.my
LSP 401 General English	2	I & II	The advanced level course is offered to students from the School of Education Arts, School of Fine Arts, School of Humanities and School of Social Sciences. This course aims to enhance students' grasp of English language skills viz reading, writing, listening and speaking in academic, social and occupational contexts. This course will also develop students' understanding and application of 'soft skills'. In addition, this course will hone students' analytical and evaluative skills, develop sell-esteem and resilience **Assessment:** Coursework 50%, Final Examination 50%	Ms. Florence Nagaratnam 04-653 3405 Florence@usm.my

LSP 402 Scientific and Medical English	2	I & II	This advanced level course is offered to students from the Schools of Biological Sciences, Chemistry, Physics, Mathematics, Industrial Technology, Education (Science stream), Medicine, Dentistry, Health Sciences and Pharmacy. This course aims to enhance English language skills in writing, reading, listening and speaking in academic, social and occupational contexts. The course will also develop the students' soft skills. Apart from that, the course will also hone analytical and evaluative skills, develop self-esteem and resilience. **Assessment:** Coursework 50%, Final Examination 50%	Ms. Oon Sok Imm 04-653 4226 sioon@usm.my
LSP 403 Business and Communication English	2	I & II	This advanced level course is offered to students from the Schools of Management and Communication. It aims to enhance students' writing, reading, listening and speaking skills in academic, social and occupational contexts. It will also develop the students' soft skills. Apart from that, it will also hone analytical and evaluative skills, and develop self-esteem and resilience. **Assessment:** Coursework 50%, Final Examination 50%	Ms. Chew Saw Cheng 04-653 4528 scchew@usm.my
LSP 404 Technical and Engineering English	2	I & II	This advanced level course is offered to students from the Schools of Computer Sciences; Housing, Building and Planning; and Engineering. This course aims to enhance English language skills in writing, reading, listening and speaking in academic, social and occupational contexts. The course will also develop the students' soft skills. Apart from that, the course will also hone analytical and evaluative skills, develop self-esteem and resilience. **Assessment:** Coursework 50%, Final Examination 50%	Mr. Rajpal Singh 04-653 2646 rajpal@usm.my
LHP 451 Effective Reading	2	I & II	By the end of this course, students should be able to : 1. identify the topic, topic sentence, main ideas, major and minor supporting sentences of a text. 2. read different types of texts critically. 3. make an outline based on a text. 4. use different reading strategies effectively. **Assessment:** Coursework 40%, Final Examination 60%	Ms. Akmar Mohamad 04-653 3976 akmar@usm.my
LHP 453 Creative Writing	2	I & II	At the end of the course, students should be able to: 1. gather and develop ideas for various creative texts 2. develop and improve writing style through style rules, word choice and grammatical accuracy 3. develop plot, theme, characterisation and dialogue for short stories **Assessment:** Coursework 70%, Final Examination 30%	Mr. Ahmad Sofwan 04-653 4123 svpathma@usm.my
LHP 454 Academic Writing	2	I & II	At the end of the course, students will be able to: a. write pieces of academic writing effectively for a variety of purposes; b. express themselves coherently a particular idea or notion based on language functions; c. use appropriate structures when writing academic material based on language functions that are used to express a particular notion or idea; and d. use quotations and references for other authors' writings. **Assessment:** Coursework 40%, Final Examination 60%	Ms. Julie Chuah 04-653 2649 cscju@usm.my

LHP 455 English Pronunciation Skills	2	I & II	This course involves the study of the English sound systems. It introduces the description and classification of speech sounds. This course is a practical starting point for students who have a strong understanding of the language and want to improve their English pronunciation. It starts with an introduction to the nature and organs of speech with the basic pronunciation guides including work on the IPA (International Phonetic Alphabet) and is followed by continued refinement of English pronunciation skills. It also focuses on improving pronunciation through the recognition of the "time-stresses" character of English. At the end of the course, students should have developed skills in perceiving and articulating speech sounds specifically and improve their pronunciation in general. **Assessment:** Coursework 100%	Ms. Toh Chwee Hiang 04-653 4994 chtoh@usm.my
LHP 456 Spoken English	2	I & II	At the end of the course, students should be able to: 1. give presentations on current issues effectively; 2. analyse and evaluate topics critically; 3. conduct meetings and panel discussions effectively; 4. speak on current issues and participate in debates; and 5. present ideas coherently through the use of appropriate speech features and strategies. **Assessment:** Coursework 100%	Ms. Gooi Poh Hong 04-653 3403 phgooi@usm.my
LHP 457 Speech Writing and Public Speaking	2	I & II	At the end of this course students will be able to: 1. organise ideas and structure them into speeches for a variety of contexts 2. deliver speeches using the appropriate organisational structures 3. deliver speeches effectively and confidently 4. write structured speeches for a variety of occasions 5. identify and analyse the structural organisation of written speeches **Assessment:** Coursework 50%, Final Examination 50%	Dr. Sunny Tan 04-653 3338 sunnytan@usm.my
LHP 459 English for Interpretation	2	I	This course is intended to help students improve on their ability to understand spoken English and transfer messages orally and correctly in English. It is designed with students of Interpreting in mind. In it, students are exposed to a variety of spoken texts to enable them to recognize and appreciate the roles words, expressions, syntax, stress and tone of voices, etc play in creating meaning, and to react accordingly with respect to these texts. In short, the course gives students opportunities to listen to authentic oral texts and express themselves orally. **Assessment:** Coursework 40%, Final Examination 60%	Assoc. Prof. Tengku Sepora 04-653 3149 tsepora@usm.my
LET 101 Introduction to World Languages and Multilingualism	4	I	1. To enable students to understand how and why certain languages gain supremacy over others and how geo-political and socio-cultural factors determine such a process 2. To enable students to identify varieties of English and demonstrate an understanding of their rise and development. 3. To enable students to identify and elaborate on the factors that give rise to multilingualism and the issues and controversy surrounding it. 4. To enable students to identify different discursive practices. 5. To enable students to explain how and why language use, development and policies are influenced by global issues related to sustainability. **Assessment:** Coursework 60%, Final Examination 40%	Dr. Sunny Tan 04-653 3338 sunnytan@usm.my
LET 102 The History and Structure of English	4	I	Students who complete this course will be aware of the role of phonology, comparative linguistics, grammar, vocabulary and word formation, and different dialects in the formation of texts. Students will also explore non-linguistic elements such as history and culture to help them appreciate and understand texts. The course will also include topics in generative grammar and, lexical and transformation rules. **Assessment:** Coursework 60%, Final Examination 40%	Dr. Thomas Chow 04-653 4125 tomichow@usm.my

LET 103 Introduction to Linguistics and Linguistic Meaning	4	I	At the end of the course, students will be able to: 1. understand how and why we study languages and what are the components of languages. 2. identify the similarities and differences between languages such as the concepts of lexis, syntax, morphology, phonetic, etc. 3. understand the significance of language and meaning in communication. 4. understand theories related to language, renowned linguists and various fields of language studies. 5. discuss some current language issues. **Assessment:** Coursework 40%, Final Examination 60%	Assoc. Prof. Tengku Sepora 04-653 3149 tsepora@usm.my
LET 104 The Study of English Grammar	4	II	At the end of the course, students will be able to: 1. understand Chomsky's Innate Linguistic Knowledge; 2. differentiate between Language Competence and Language Performance; 3. identify the main elements in English Grammar using the principles of linguistic analysis; 4. analyse sentences according to their type and functions in sentence classes; and 5. evaluate morphological and syntactic developments in the English language **Assessment:** Coursework 60%, Final Examination 40%	Ms. Toh Chwee Hiang 04-653 4994 chtoh@usm.my
LET 105 The Study of English Literature	4	II	At the end of the course, students will be able to: • demonstrate, through close and personal analysis, knowledge of the literary texts studied; • respond with knowledge and understanding to a variety of literary texts of different forms and contexts; • demonstrate understanding of the ways in which writers' choices of form, structure and language shape meanings; • communicate a sensitive and informed personal response to what is read; and • express responses clearly and coherently, using textual evidence where appropriate. **Assessment:** Coursework 60%, Final Examination 40%	Dr. Thomas Chow 04-653 4125 tomichow@usm.my
LET 106 Professional Reading	4	II	At the end of the course, students will be able to: i. understand the relationship between literary and non-literary texts. ii. use different reading strategies to understand different types of texts. iii. use critical and analytical techniques when reading texts. **Assessment:** Coursework 40%, Final Examination 60%	Ms. Akmar Mohamad 04-653 3976 akmar@usm.my
LET 107 Writing for Professional Communication	4	II	1. To enable students to produce a variety of texts that take into consideration context of situation and appropriate registers. 2. To familiarize students with the features of professional/academic writing 3. To introduce to students the format for producing academic essays/papers 4. To enable students to write and present reports/findings. **Assessment:** Coursework 60%, Final Examination 40%	Dr. Sunny Tan 04-653 3338 sunnytan@usm.my

Course Code/ Title	Unit	Semester Offered	Synopsis	Details of Lecturer
ATW 103 Business Law	3	II	This course exposes students to principles of business law as derived from case law and statute law. It is hoped that students will have a general understanding of those laws applicable to them in a business relationship, be it as an individual/ partner or in the context of the management and running of a business entity in the Malaysian business environment.	Dr. Hazril Izwar Ibrahim 04-653 2891 hazrili@yahoo.com
ATW 104 Introduction to Management	4	I	The course aims to provide students with the theories, concepts, techniques and practices of modern management which are important in the context of business world. It has four essential management functions: planning, organizing, leading and controlling. Students are exposed to the most contemporary and up-to-date account of the changing environment of management and management practices in the real-life management context.	Dr. Noor Hazlina Ahmad hazlina@usm.my Dr. Hasliza Abdul Halim haslizahalim@usm.my
ATW 107 Microeconomics	3	I	This course gave exposure of theory fundamentals steady on a specific economic field. Microeconomics theory basic concepts by giving attention of demand theory, utility and consumer behavior concept. Other than that comprehension of individual demand with production theory and firm prefigure of his function is inside system consumer economic. At the same time cost theory, and treatment theory market such as perfect competition, monopoly and monopoly market is discussed.	Mr. Zainon Harun zainon@usm.my Mr. Ahmad Zainuddin Salleh zainuddin@usm.my
ATW 108 Macroeconomics	3	II	This course includes related basic concept macroeconomics - economic theory, model and methodology. Economic fluctuation, unemployment and inflation issue, demand and aggregate supply, policy fiscal, money and system banking and monetary policy is inside important aspect manage macroeconomic. Discussion on balance, output and input, international economy and economic growth expand macroeconomic scope to understand.	Mr. Zainon Harun 04-653 2532 zainon@usm.my Dr. Tajul Ariffin Masron 04-653 2755 tams@usm.my
ATW 112E Business Communication I	2	I	This course has been designed to increase student's awareness about the functions and significance of communication in the business world. This course focuses on the application of communication principles in achieving business objective. Special attention is given in developing, listening and conversational skill.	Dr. Daisy Kee Mui Hung daisy@usm.my Dr. Lilis Surienty Abd. Talib lilis@usm.my Dr. Mohd. Anuar Arshad arshadalbenjari@usm.my

ATW 113E Business Communication II	2	II	This course has been designed to increase student's awareness about the functions and significance of communication in the business world. This course focuses on the application of communication principles in achieving business objective. Special attention is given to the development of writing and conversational skill.	Dr. Noor Hazlina Ahmad hazlina@usm.my Dr. Hasliza Abdul Halim haslizahalim@usm.my
ATW 114 Financial Accounting	4	I	This course introduces the principles of financial accounting to students which encompasses basic accounting concept and model, accounting cycle, cash and internal control, sales debtors, purchase, creditors and goods cost sold, fixed asset, intangible asset and depreciation, inventory and partnership.	Mr. Chee Hong Kok 04-653 3354 hkchee@usm.my
ATW 124 Introduction to Managerial Psychology	3	II	This course exposes students to managerial psychology. This course incorporates a study of the theories and research about basic managerial topics in psychology as well as their relationship to the psychological functioning of the individual as a social being. Students will develop an insight into managing themselves as well as working with and managing others, more effectively. Prerequisite: ATW104/4	Dr. Lilis Surienty Abd. Talib 04-653 3368 lilis@usm.my Dr. Azura Abdullah Effendi 04-653 3343 azura_a_e@yahoo.com
ATW 125 Business Statistics	4	I	This course aims to provide basic statistical method which is required in management studies. The concepts to be discussed in this course includes descriptive statistics, probability, probability distribution, sampling and sampling distribution, estimation, hypothesis testing (one and two populations), analysis of variance, chi square analysis, correlations and regression analysis and multiple regression. In doing analysis the student will also be exposed to the use of SPSS software.	Mr. Yusof Hamdani Jelalludin 04-653 3430 yhamdani@usm.my
ATW 202 Business Research Method	3	I	This course is to give exposure to students regarding issues in research, formulation of problems, hypothesis, theories, research evaluation, research design, data measurement and collection, sampling, data analysis and research report writing.	Assoc. Prof. T. Ramayah 04-653 3889 ramayah@usm.my
ATW 212 Accounting Management	4	I	This course aims to give a lead to students on planning, control and decision making are among several management main functions. The main focus of this course is to provide accounting information production to be used by managers in planning and supervising business operations and to make specific decision when necessary. Important account information is emphasized in this course is goods cost, activity, and budget.	Dr. Ainuddin Bahari 04-653 3379 ainuddin@usm.my
ATW 223 Operations Management	3	II	This course contains the theories and applications of operations management. It comprises strategies, tactics and operations of management of the transformation processes and the delivery of goods and services. Therefore, this course considers operations management problems and provides qualitative and quantitative solutions to improve efficiency and effectiveness.	Mr. Soh Keng Lin 04-653 2317 klsoh@usm.my
ATW 242 Principles of Marketing	4	I	This course is an introduction of marketing course to students. It encompasses theory and marketing philosophy that focuses on elements such as product, price, place and promotion which is the foundation of marketing theory building. In addition students are also be given exposure how environmental factors such as technology development, consumer, marketing and global community can influence the practice of current marketing practices.	Ms. Iman Khalid Abd. Qader 04-653 2525 iman@usm.my

ATW 252 Organisational Behaviour	4	II	This course is designed to provide students with the knowledge of the complex interplay between people and the organizations in which they work. It prepares them to appreciate how the findings of behavioral sciences can be applied to the solutions of problems involving human behavior in the workplace. Pre-requisite: ATW104/3	Mr. Quah Chun Hoo eq@notes.usm.my Dr. Daisy Kee Mui Hung daisy@usm.my
ATW 262 Principles of Finance	4	I	This course exposes student to the function of finance. It also introduces the basic concepts in finance such as time value of money and; risk and return in order to make financial decisions.	Assoc. Prof. Zamri Ahmad 04-653 2398 zahmad@usm.my Dr. Abdul Hadi Zulkafli 04-653 3953 hadi_zml@usm.my
ATW 393E Strategic Management	4	II	This course concentrates on ways in formulating, implementing, and evaluating strategies. Strategic-management concepts and techniques are studied. Students will use the knowledge acquired from previous business courses, coupled with new strategic management techniques learned, to chart the future direction of different organizations.	Dr. Azura Abdullah Effendi 04-653 3343 azura@usm.my Mr. Mohd. Yussof Zainun Hamzah 04-653 2526 zmyussof@usm.my
ATW 395 International Business	3	I & II	This course aims to introduce students to the issues of international business and globalization. Among the topics to be covered are international trade and investment, international financial markets, and managing international operations.	Dr. Shankar Chelliah shankar@usm.my Dr. Yusliza yusliza@usm.my 04-653 5282
AFW 360 Corporate Finance	3	II	This course will give further exposure to the students to the basic concepts of finance like time value of money, valuation, and risk and return. These concepts will be applied in the in-depth discussion on capital budgeting, dividend policy and capital structure. The students will learn how financial managers use finance concepts in making investment and financing decisions in order to maximize value. Besides, mergers and acquisitions, and international finance will also be covered. Prerequisite: ATW262/4	Assoc. Prof. Zamri Ahmad 04-657 7888 zahmad@usm.my Dr. Abdul Hadi Zulkafli 04-657 3953 hadi_zml@usm.my
AFW 362 Management of Financial Institutions and Markets	3	II	This course exposes students to the function of markets and financial institutions. The focus of the course is on the management of financial institutions, rules and regulations, plans and financial analysis. The course starts with topics related to financial markets. It also analyzes the basic issues such as credit, liquidity, capital and bank mergers. Prerequisite: ATW262/4	Datin Dr. Joriah Muhammad 04-653 3880 joriah@usm.my

AFW 364 Analysis of Financial Statements	3	I	This course emphasizes on how to manage and use the firm financial information and the financial concepts. These concepts are important in analyzing the financial data and making the decision from the economic perspective. Prerequisite: ATW262/4	Dr. Haslindar Ibrahim 04-653 2894 hasliadar@usm.my Dr. Eliza Nor 04-653 2520 eliza.nor@usm.my
AFW 365E International Finance	4	II	This course exposes students to international finance. Three dimensions distinguish international finance from domestic finance. They are i) foreign exchange and political risks, ii) market imperfections, and iii) expanded opportunity sets. Financial managers should learn how to manage foreign exchange and political risk using proper tools and instruments, deal with (and take advantage of) market imperfections, and benefit from the expanded investment and financing opportunities. Prerequisite: ATW262/4	Dr. Hooy Chee Wooi 04-653 2897 cwhooy@usm.my
AFW 369E Securities Investment & Portfolio Management	4	II	This course is an introductory investment course. Students will be exposed to the available investment alternatives and to the theory and practice of investments and portfolio management. This course covers the primary financial securities stocks, bonds, and derivatives, and methods for combining these underlying assets into a portfolio. Prerequisite: ATW262/4	Dr. Hooy Chee Wooi 04-653 2897 cwhooy@usm.my
AMP 346E International Marketing	4	I	This course aims to introduce students to the theories and activities of marketing management at the international level. Students should understand the effects of environmental factors and the organizations culture on the tendency to explore the international market, the method to enter the foreign market and planning necessary strategies. Prerequisites: ATW242/3	Dr. Khairul Anuar Mohd Shah 04-653 5283 khairulms@usm.my
AMW 340 Services Marketing	3	I	This course aims to introduce students to the skills of marketing the services particularly by service organizations. Students will be introduced with the marketing concepts and service model, to understand the importance planning processes, marketing strategies and promotional issues which are related to the supply of services. Prerequisites: ATW123/4, ATP201/3, ATW241/3	Dr. Azizah Omar 04-653 2889 aziomar@usm.my
AMP 342 Consumer Behaviour	3	I & II	This course involves the thoughts that people experience and the actions they perform in consummation processes. It also includes all elements in the environment that influence these thoughts, feelings and actions. These include comments from other consumers, advertisements, price information, packaging, product appearance, and many others. Prerequisites: ATW242/3	Assoc. Prof. Dato' Ishak Ismail iishak@usm.my
AMW 343 Marketing Research	3	I & II	This course provides understanding on the research techniques in the marketing functions. It involves design development, data source, data collection methodology, sampling, data analysis, preparation of research report and the importance of research in the decision making process. Prerequisites: ATW125/4, ATW242/3	Dr. Mehmod Sabri 04-653 3434 msabri@usm.my
AMW 345 Integrated Marketing Communication	4	I & II	This course emphasises the role and importance of integrated marketing communication as one of the promotion methods in marketing. Students will be exposed to how advertising is planned and implemented; media planning and selection; its use as a marketing tool in influencing consumer behaviour; copy and artwork preparation; advertising laws and regulations. Prerequisites: ATW125/4, ATW242/3	

Course	Units	Semester	Description	Contact
AMW 347E Strategic Marketing	4	II	This course will introduce to student, understanding of strategic marketing management and its relationship with corporate strategy. Decision making analytical technique, strategic marketing analysis, internal and external situational analysis, strategic marketing models and marketing strategies would be discussed in this course. Prerequisites: ATW125/4, ATW242/3	Mr. Mohd. Shafie Ariffin mshafie@usm.my
AMW 348 Retailing	4	I	This course concentrates on the marketing issues of retailing. It covers the management of retailing institution (purchasing policy, pricing determination, management information system and sales person management). This course also discusses the influence of consumer behaviour, technological change and change of business structure in retailing.	Dr. Malliga Marimuthu 04-653 2753 malliga@usm.my
AOW 353 Organisational Theory	4	II	This course exposes students to the concepts of organizational theory and structure. Students will also be taught how to apply these theories and concepts in an organization and it environment to ascertain that organizational effectiveness is achieved. Prerequisite: ATW104/4, ATW252/3	Assoc. Prof. Aizzat Hj. Mohd. Nasurdin 04-653 2548 aizzat@usm.my
AOW 355 Industrial Relations	3	I	The course aims to provide students an overall understanding and exposure of Malaysian industrial relation laws and practices. Students are also exposed to the processes of industrial relations from the perspectives of management and unions/employees representatives Prerequisite: ATW252/3	
AOW 356E International Management	3	I & II	This course exposes students to the concepts and contemporary issues of international management. Similarities and differences between international and domestic management styles would also be compared.	
AOW 360 Management Psychology	3	II	This course highlights the theoretical underpinnings of the application of psychological principles in the management of organizations. Students will develop a deeper insight into managing themselves as well as working with and managing others, more effectively. Prerequisite: ATW252/3, ATW104/4	
APP 373 Productivity and Quality Control	4	II	This course contains concepts, theories, knowledge and techniques of quality control, quality assurance, total quality management, quality systems and standards. The impact of quality improvement and its assurance upon enterprise productivity will also be discussed. Appropriate operations management software will be introduced wherever applicable. Prerequisite: ATW223/3	Mr. Soh Keng Lin 04-653 2317 klsoh@usm.my
APP 378 Technology and Innovation Management	4	II	This course aims to provide exposure to the concept of technology management and innovation, the importance and impact of technology management and innovation to organizations performance. The scope of learning will cover the role of technology in value creation, competition advantage, development of technology, integration of technology management in the organizational planning, life cycle of technology, research and development, and management of technology resources and linkages.	Dr. Marini Nurbanum Mohamad 04-653 5151 marini_nur@usm.my
APP 381 Service Operations Management	4	I	This course consists of knowledge and skills of service operations management for example the service concept, new service development, customers and customer relationships, customers expectations and satisfaction, moments of truth, management of service supply chain, service providers, resource utilization, operations improvement, service quantitative models, service strategies, service culture and complexity of operations. Prerequisite: ATW223/3	Dr. Marini Nurbanum Mohamad 04-653 5151 marini_nur@usm.my

APW 302E Management Information System	3	II	This course exposes students to MIS and organization, data and information, computer technology and the database management system. The contents include the role of MIS in organizations, the concept of data and information such as representation files and tools, computer technology such as CPU and number systems, input and output, data storage, communication and information system design	Assoc. Prof. T. Ramayah 04-653 3889 ramayah@usm.my Web Page: http://www.ramayah.com
ATU 397 Management Studies	4	I & II	This course contains management project which is an introductory course for students who are interested in extending their management knowledge in terms of doing research in specific areas of management practices. The course will provide students with a chance to learn how to conduct a proper academic research. A good knowledge on basic statistic is needed for this course.	Dr. Mahmod Sabri Haron 04-653 3434 msabri@usm.my

Course Code/ Title	Unit	Semester Offered	Synopsis	Details of Lecturer
ZCA 101 Physics I (Mechanics)	4	I	Unit and dimension. Kinematics in one and two dimension. Vectors in physics. Newton's Laws and application. Work and energy. Conservation of energy and momentum. Collision in one and two dimension. Simple harmonic motion. Universal gravitation, gravitional force. Motion of planets. Extended systems, moment of inertia. Angular momentum, rotational dynamics, compound pendulum. Rigid body, equilibrium, statics. Elasticity, stress, strain and torsion. Young's modulus, shear and bulk modulus. Bending of beams, bending moment. Compression of fluids, surface tension, hydrostatics, viscosity, viscoelasticity. Hydrodynamics, continuity equation, Bernoulli equation, Poisseuille equation. Turbulent flow, sedimentation, drags. **Assessment:** Coursework 30%, Final Examination 70%	Dr. Ong Lye Hock 04-653 5105 onglh@usm.my Dr. Ng Sha Shiong 04-653 3041 shashiong@usm.my
ZCA 102 Physics II (Electricity and Magnetism)	4	I	Coulomb's law, electric intensity. Gauss's law, electric flux. Electric potential and electric intensity of point charges, dipole and charge distributions. Capacitance, dielectrics, stored energy. Electric current, resistance, Ohm's law, Kirchhoff's law. Microscopic view of current. D.C. RC circuit. Magnetic fields, Ampere's law, Biot-Savart law. Faraday's law. Lenz's law. Inductance, stored energy, D.C. LR circuit. A.C. current, electric power, RCL circuit. Force on current and moving charge. Lorentz equation, Hall's effect. Dielectric materials, dipole moment, electric polarization. Material resistivity, temperature effect. Electromagnetic waves, electromagnetic spectrum. Magnetic field and electric field vector. Maxwell displacement current, Maxwell equations. **Assessment:** Coursework 30%, Final Examination 70%	Dr. Adilah Shariff 04-653 3049 adilah@usm.my Dr. Nurhayati Abdullah 04-653 2475 nurhaya@usm.my
ZCA 110 Calculus and Linear Algebra	4	I	Sets, real numbers, rational and complex numbers. Functions and graphs. Sequences and series, convergence tests, function limits and properties of limit, continuity, and the mean value theorem. Differentation techniques, implicit differentiation, higher order differentiation, minimum and maximum values (theory and application), Rolle's theorem, L'Hopital's rule, applications of derivatives. Integration techniques, improper integrals, fundamental theorem, lengths of curves. Trigonometric functions and their inverses, exponential and logarithmic functions, hyperbolic functions and their inverses. Matrices and Determinants: Matrix algebra, determinant, properties of determinant, inverse of a matrix, systems of equations, vector spaces, Basis and dimension, linear transformations. **Assessment:** Coursework 30%, Final Examination 70%	Dr. Wong Kai Meng 04-653 3678 kmwong@usm.my Dr. Norhaslinda Mohamed Tahrin 04-653 2477 haslinda@usm.my

ZGT 161 Geology I	3	I	Introduction to geology, basic principles and concepts. Origin of the earth. Internal structure of the earth from seismology. Introduction to principles of isostasy. Crustal and isostatic structure of continental margins, mountain ranges, oceanic ridges, plateau uplifts (hot spots). Introduction to continental drift, plate tectonics, sea-floor spreading, passive margins, subduction zones and active margins, extensional sedimentary basins (McKenzie mechanism). Basic mineralogy: properties, composition and structure of minerals. Rock-forming minerals. Composition, textures, structures, formation and classification of sedimentary, igneous and metamorphic rocks. Forms of igneous bodies. Fossils. Geological time scale. Basic stratigraphy: unconformities, diastems, facies, geological correlation. Rock deformation: folding, faulting, joints. Prerequisite: (C) ZCA 101/4 Physics I (Mechanics) **Assessment:** Coursework 30%, Final Examination 70%	Mr. Khairul Arifin Mohd. Noh 04-653 3674 khaiarif@usm.my
ZCT 191 Physics Practical	2	I	Upon completion of this course, students are expected to have enhanced their understanding of the basic concepts of Physics, capable to handle various equipments in the laboratory and able to prepare a well structured laboratory formal report. **Assessment:** Coursework 100%	Mr. Ibrahim Mustapha 04-653 3653 mibrahim@usm.my
ZCT 206 Electronics II	3	I	Numbers and code system, arithmetic of binary, hexadecimal, and 2's complement numbers. Basic logic, Boolean algebra, de Morgan theorem, and logic circuit analysis. Design of combinational logic circuits, minimization, Karnaugh map, don't care state, decoder, multiplexer, encoder, and demiltiplexer. Combinational logic elements: basic flip-flop, flip-flop SR, JK, D, and T. Clocked flip-flops. Sequential logic: different types of reigsters and counters. Sequential timing, synchronous and asynchronous counters and their applications. Arithmetic's unit: adder and substracter. Design of sequential logic systems: state diagram, truth table, and timing diagram. Extension from exited table, circuit design from truth table and timing diagram. Examples of logic circuit applications: memory system, ROM, RAM, memory decoding, and basic architecture of microprocessor system. This course exposes students to practical experiences on various experiments to enhance theories such as: Experiments on logic gates, flip-flop, arithmetic unit, design of registers and counters. Prerequisite: (S) ZCT 106/3 Electronics I **Assessment:** Coursework 30%, Final Examination 70%	Dr. Yam Fong Kwong 04-653 4178 yamfk@usm.my
ZCT 210 Complex Analysis and Differential Equations	4	I	Complex Analysis: Funtions of a complex variable - complex functions. Differentiation of complex functions; Cauchy-Riemann conditions, analytic functions, singular points, power series of analytic functions, Taylor series. Complex Integration: Cauchy integral theorem. Cauchy integral formula. Zeroes and singularities. Laurent series. Residue theorem. Differential Equations: Ordinary linear differential equations of first order and methods of solutions. Ordinary linear differential equations of second order – homogeneons and non-homogeneous equations and methods of solution. Differential Equations: Series solution - power series and Frobenius methods. Prerequisite: (S) MAA 101/4 Calculus or (S) ZCA 110/4 Calculus and Linear Algebra **Assessment:** Coursework 30%, Final Examination 70%	Assoc. Prof. Lim Siew Choo 04-653 5108 sclim@usm.my

ZCT 211 Vector Analysis	2	I	Vector algebra; definitions, addditon, subtraction of vectors, dot products and cross products of vectors, scalar and vector fields, geometric representation, algebraic representation, transformation; unit vectors. Vector calculus; scalar differentiation, differentiation with respect to time. Gradient, divergence and curl of a vector. Physical examples. Consecutive differentiation, Laplacean, D'Alembertian. Physical examples. Vector integration; line, surface and volume integrals. Gauss Theorem. Stokes Theorem. Application in Physics; potential theory, scalar potential, vector potential. Coordinate Systems; Cartesian, curvilinear systems, cylindrical, spherical. Differentiation and integration. Application in Physics, position, velocity and acceleration, wave equation for $\underset{\sim}{E}$ and $\underset{\sim}{H}$ in electricity and magnetism. Prerequisite: (S) MAA 101/4 Calculus or (S) ZCA 110/4 Calculus and Linear Algebra **Assessment:** Coursework 30%, Final Examination 70%	Dr. Low Ah Chuan 04-653 2474 aclow@usm.my
ZCT 212 Thermodynamics	2	I	Simple thermodynamic systems, equation of state, work, heat, first law, internal energy, results of first law, ideal gas. Carnot cycle and heat engine. Second law of thermodynamics, result from second law, entropy, irreversible process. Combination of first and second laws, T-S diagram and thermodynamic relationships. Maxwell equation, Clausius- Clapeyron equation and Tds equation. Prerequisite: (S) ZCA 102/4 Physics II (Electricity and Magnetism) **Assessment:** Coursework 30%, Final Examination 70%	Assoc. Prof. Fauziah Sulaiman 04-653 3654 fauziahsulaiman@ usm.my
ZCT 213 Optics	2	I	Polarization. Plane and circular polarization. Reflection and transmission of electromagnetic waves at boundaries. Opticall activity. Kerr effect and Faraday effect. Dispersion theory. Diffraction. Fresnel-Kirchhoff equations. Fraunhofer diffraction of a single slit, square and circular aperture. Diffraction gratings and their characteristics. Fresnel diffraction for circular aperture. Cornu spiral and Fresnel Integrals. Zone plates. Fresnel diffraction for straight edges and rectangular aperture. Prerequisite: (P) ZCT 103/3 Physics III (Vibration, Waves and Optics) **Assessment:** Coursework 30%, Final Examination 70%	Prof. Zainuriah Hassan 04-653 3650 zai@usm.my
ZGT 265 Meteorology I	3	I	Introduction: Structure, composition, layering, pressure, density and temperature-height profile of the atmosphere. Atmospheric thermodynamics: dry adiabatic lapse rate, thermodynamic laws, hydrostatic balance, geopotential, humidity, hipsometric equation, adiabatic process, tepigram. Parcel method, static energy. Thermal stability. Radiation: radiative transfer, global radiation budget, greenhouse effect, effective temperature. Pressure gradient force, local wind systems. General circulation, single and three cell models. Clouds: Development of cloud droplets, growth of raindrops by condensation, collision, coalescence. Cloud dynamics, rain and snow. Local storms. Prerequisite: (C) ZCT 212/2 Thermodynamics **Assessment:** Coursework 30%, Final Examination 70%	Dr. Lim Hwee San 04-653 3663 hslim@usm.my

ZGT 266 Solid Earth Geophysics I	3	I	Earthquakes, what and where. Properties of elastic wave propagation. Knott's and Zoeppritz's equations. Seismic waves at distances of 0-10o, 10-103o, > 103o. Travel time tables and the IASPEI 91 velocity model. Recording systems, instrument frequency properties and seismometry. Strong motion analysis. Structure and composition of the crust, mantle and core: crust, Mohorovicic discontinuity, mantle, transition zone and core. Earth rheology: effect of stress, mantle viscosity, shock wave experiments. Thermal history of the earth: submarine and terrestrial heat flow, temperature distribution. Geochronology: radioactivity, age determination methods such as the Rb-Sr, K-Ar, U, Th-Pb, Pb and Carbon-14 methods. Prerequisite: (S) ZGT 162/3 Geology II **Assessment:** Coursework 30%, Final Examination 70%	👤 Assoc. Prof. Mohd. Nawawi Mohd. Nordin 📞 04-653 2473 🖱 mnawawi@usm.my 👤 Dr. Lim Hwee San 📞 04-653 3663 🖱 hslim@usm.my
ZGT 268 Exploration Geophysics I	3	I	Introduction to seismic methods: seismic waves, reflection, refraction, diffraction. Geophones, hydrophones, energy sources, recording equipment. Position-fixing methods. Seismic reflection method: data acquisition on land and offshore, data reduction, processing, velocity determination, interpretation, applications. Seismic refraction method: data acquisition, reduction, processing, interpretation, applications. Prerequisite: (S) ZGT 266/3 Solid Earth Geophysics I **Assessment:** Coursework 30%, Final Examination 70%	👤 Dr. Rosli Saad 📞 04-653 3675 🖱 rosli@usm.my
ZGT 272 Introduction to Oceanography	3	I	Shape of ocean basins, continental margins, morphology of the ocean floor. Temperature, salinity and density distributions in oceans. Light and sound in sea water. Composition of sea water, chemical and biological reactions in sea water. Air-sea interaction, heat and water cycles. Causes of instability in oceans. Ocean circulation, current measurement. Causes of currents; pressure gradient, Coriolis forces, geostrophic flow, wind-driven circulation. Waves and tides. Marine biology. Prerequisite: (P) ZCA 101/4 Physics I (Mechanics) (S) ZGT 162/3 Geology II **Assessment:** Coursework 30%, Final Examination 70%	👤 Dr. Md. Noordin Abu Bakar 📞 04-653 5106 🖱 mnoordin@usm.my
ZGE 277 Structure of the Universe	4	I	Size of the Universe. Electromagnetic waves as carriers of information. Understanding the Solar System. Stars and the H-R diagram. Stellar evolution. Galaxies. Cosmology. Probability of extraterrestrial lifeforms. **Assessment:** Coursework 30%, Final Examination 70%	👤 Assoc. Prof. Abdul Halim Abdul Aziz 📞 04-653 5103 🖱 abdul@usm.my 👤 Assoc. Prof. Chong Hon Yew 📞 04-653 3665 🖱 hychong@usm.my
ZAE 282 Materials Science	3	I	Introduction. Structure: Crystal structure and imperfections, phase diagrams, phase transformations, diffusion, deformation of materials, strengthening mechanisms and microstructures, corrosion and oxidation. Materials: Iron, steel and ferrous alloys, non-ferrous metals and alloys, polymers, ceramics, composites. Properties: Physical properties of materials. Prerequisite: (C) ZCT 212/2 Thermodynamics **Assessment:** Coursework 30%, Final Examination 70%	👤 Dr. Mutharasu 📞 04-653 3041 🖱 mutharasu@usm.my

ZCT 293 Physics Practicals III	2	I	Consist of a selection of experiments. Prerequisite: (S) ZCT 192/2 Physics Practicals II **Assessment:** Coursework 100%	👤 Assoc. Prof. Abdul Razak Ibrahim 📞 04-653 5105 🖱 arazaki@usm.my
ZGT 295 Geophysics Practicals	4	I	Experiments in geophysics and Geophysical Field Camp. Prerequisite: (S) ZGT 190/2 Geology Practicals	👤 Dr. Rosli Saad 📞 04-653 3675 🖱 rosli@usm.my
ZGT 297 Practical Training	3	I	Practical Training Prerequisite: (S) ZCT 192/2 Physics Practicals II **Assessment:** Coursework 100%	👤 Mr. Wong Chow Jeng 📞 04-653 5107 🖱 wongcj@usm.my
ZCE 305 Atomic and Nuclear Physics	3	I	Atomic structure: Hydrogen atom. States in hydrogen atom. Angular momentum. Many electron atom. Electron spin. Pauli exclusion principle. Symmetric and Antisymmetric wave functions. Spin orbit coupling. LS and JJ coupling. Atomic spectra. Selection rules. One valence electron-atom. Zeeman effect, Normal and Anomalous. Nuclear structure: General properties of nuclear - composition, size, form, mass and atomic nuclear charge. Nuclear force and deuteron problem. Radioactivity, alpha decay, gama decay, electron capture. Internal conversion. Nuclear reactions. Nuclear models and magic numbers. Prerequisite: (S) ZCT 205/3 Quantum Mechanics **Assessment:** Coursework 30%, Final Examination 70%	👤 Assoc. Prof. Abdul Razak Ibrahim 📞 04-653 5105 🖱 arazaki@usm.my
ZCT 307 Solid State Physics I	3	I	Crystal structure, classification of interatomic binding in crystals. Diffraction, reciprocal lattice, Brillouin zone, lattice vibration, dispersion curve, specific heat-models of Einstein and Debye. Free electron theory for metals, electrical conductivity, electron gas heat capacity. Band theory of solids, Kronig-Penney model, holes, effective mass. Semiconductor - intrinsic and extrinsic. Carrier density. Conductivity of impurities, Hall effect. Optical properties: absorption processes, exciton, photoconductivity. Prerequisite: (C) ZCT 207/2 Statistical Mechanics **Assessment:** Coursework 30%, Final Examination 70%	👤 Assoc. Prof. Sohail Aziz Khan 📞 04-653 4178 🖱 sakhani@usm.my

ZKT 321 The engineer in Society	3	I	**Code of Ethics:** Role and responsibilities of an engineer, health and safety in the workplace, communication, development and influence of technology. **Management:** Introduction to management theory, fixed and variable costs; management processes: planning, organising, marketing, finance, personnel and leadership. **Legal Aspects:** General legal principles, classification, source, structure of the Malaysian Courts, exemplary doctrines, industrial court, arbitration. **Contract laws:** Formulating contracts, invalidity, exclusion clause, breaking of contracts, amendments. **Agency laws:** Formulation and dissolution, responsibilities of principals and agents, responsibility of principals to third parties. **Intellectual property laws:** Patents and release of patent rights. **Labour laws:** Work contracts, employer responsibilities, health and safety in the workplace. **Laws of tort:** Negligence, responsibilities of manufacturer. **Assessment:** Coursework 30%, Final Examination 70%	Dr. Shahrom Mahmud 04-653 3643 shahromx@usm.my
ZKE 322 Electronic and photonic Materials II	3	I	**Ferroelectrics:** Basic ideas. Displacive ferroelectrics. Relaxor ferroelectrics. Landau theory of displacive transitions. Susceptibility divergence. Materials design of perovskite ceramics for specific applications. Properties of PZT family. Applications of bulk type ferroelectrics; capacitors, pyroelectric detectors, strain sensors and actuators, nonlinear optic crystals. Applications of ferroelectrics thin film; capacitors, DRAM elements in ICs. Processing routes and integration with IC technology. Liquid crystals: Basic definitions. Nematic ordering, definition of direction. Alignment of direction by electric and magnetic fields and by pinning at surfaces. Free energy in direction of divergence and curl. Electric field alignment and Frederiks transitions. Optical anisotropy. Rotation of optical polarization in pure twist cell. Chiral molecules and cholesteric ordering. Pitch of cholesteric spiral and variation with temperature. Smectic ordering. SmA, SmC and SmC*. Simple applications in display devices. Twisted nematic display cell and operation. Dipole switching of SmC* cells and possible applications. Definations of B, H, M. Hysteresis loops of ferromagnets, materials, domain walls. Ferromagnetic thin film. Microwave applications and ferrite devices. Prerequisite: (S) ZKT 222/3 Electronic and Photonic Materials I (C) ZCT 307/3 Solid State Physics I **Assessment:** Coursework 30%, Final Examination 70%	Dr. Khalid Mutashar Omar 04-653 3673 khalhadithi@usm.my

Code	Units	Sem	Synopsis	Lecturer
ZKE 323 Electronic and photonic Devices and systems	3	I	Electronic devices: Zener diode, tunnel diode, FET, MOSFET, UJT, SCR. LASCR, Programmable logic controller (PLC). Source and detectors: Lamps, LEDs, lasers, PMT, photodiodes, phototransistors, infrared and microwave sources and detectors. Electro-optic devices: Modulators (magneto-optic and acousto-optic), optical switches, liquid crystal display and TV, CCD, integrated optics. Optical instruments: Microscopes, interferometer, radiometer, cameras spectrometers. Prerequisite: (S) ZCT 106/4 Electronics I (S) ZCT 213/2 Optics **Assessment:** Coursework 30%, Final Examination 70%	Prof. Mat Johar Abdullah 04-653 3679 matjohar@usm.my
ZCE 331 Radiation Biophysics	4	I	Interaction of radiation with matter. Interaction mechanism of photons and electrons with matter. Interaction of neutrons, alpha particles, heavy nuclei and nuclear fission fragments with matter. Detection and measurement of radiation. Radiation dosimetry. Production of radionuclides and its use in tracer techniques. Biological effects of radiation. Prerequisite: (P) ZCT 104/3 Physics IV (Modern Physics) **Assessment:** Coursework 30%, Final Examination 70%	Dr. Azhar Abdul Rahman 04-653 3655 arazhar@usm.my
ZME 336 Medical Instrumentations	4	I	X-ray tube and generators. CT scanners. Gamma cameras, collimator design, crystal selection, photomultiplier drift. Interface circuit. Multi-detector system and rotational gamma camera. Instrumentation in magnetic resonance imaging. Ultrasound source and detector. Characteristics of piezoelectric materials. Single element transducer design and field characteristics. Medical lasers: types, properties and medical applications. Optical microscopy and electron microscopy. Computers in medicine. Prerequisite: (S) ZCT 106/3 Electronics I **Assessment:** Coursework 30%, Final Examination 70%	Assoc. Prof. Mohamad Suhaimi Jaafar 04-653 5104 msj@usm.my
ZME 338 Physics of Medical Imaging	4	I	Photography process, solid state detector and CCD. Signal/noise and sensitivity. Calibration, horizontal field and splitting technique. Digitizer and plate scanner. Hardware for image processing, software techniques, histogram, convolution, fringe upgrading, Fourier techniques and slit synthesis. Discrete, 2-D, and fast. Fourier transforer. Laplace, Hough, Walsh and Hotelly transforms and their applications. Information acquired from imaging such as data acquired in CI., MRI, angiography, infrared and ultrasound imagings. Physical factors that may be considered in each technique to enhance imaging information. **Assessment:** Coursework 30%, Final Examination 70%	Assoc. Prof. Mohd. Zubi 04-653 3651 mjafri@usm.my
ZCE 351 X-Ray Analysis	3	I	Physics of X-ray, generation and properties of X-ray, detectors, X-ray diffraction, powder methods and single crystal methods, X-ray fluorescence, interpretation and quantitative analysis, EDX spectrometer, X-ray micro-analysis with electron microscope. Note: Exposure to equipment and practicals in the X-ray laboratory. Prerequisite: (C) ZCT 307/3 Solid State Physics I **Assessment:** Coursework 30%, Final Examination 70%	Assoc. Prof. Abdul Halim Abdul Aziz 04-653 5103 abdul@usm.my

ZGE 360 Synoptic Meteorology	3	I	Introduction to surface weather charts, the plotting meteorological codes. Air mass: features, classification, modification. Features of the frontal system, its structure and theory (classical Bergeron theory and current theory). Horizontal advection theory and the continuity equation. Non-frontal low pressure systems e.g. typhoons and tornadoes. General features of the anticyclone: warm and cold anticyclones. Development of the cyclonic system, shearing and curvature for cyclonic and anticyclonic flow. Divergence, convergence and vertical motion. Relative vorticity, potential vorticity and absolute vorticity and their relation to divergence and convergence. Features of long waves: structure and theory. Observations and analysis at the surface and upper levels. Weather forcasting: numerical modeling. Prerequisite: (S) ZGT 270/3 Meteorology II **Assessment:** Coursework 30%, Final Examination 70%	Assoc. Prof. nasirun Mohd. Saleh 04-653 2115 nasirun@usm.my
ZGE 371 Potential Field Interpretation	3	I	Interpretation of gravity and magnetic data: 2-dimensional and 3-dimensional models. Kernel function in resistivity sounding; modelling, inversion and interpretation. Introduction to non- linear optimization methods, linear inversion, generalized inverse method. Other optimization methods: simplex, least squares and steepest descent. Prerequisite: (S) ZGT 269/3 Exploration Geophysics II **Assessment:** Coursework 30%, Final Examination 70%	Assoc. Prof Mohd. Nawawi Mohd. Nordin 04-653 2473 mnawawi@usm.my
ZGT 374 Remote Sensing	3	I	Basic mathematics for Fourier Transform. Aliasing and phase considerations. Operations in the time domain and frequency domain. Preprocessing. Main processing sequence. Velocity analysis. Factors that influence velocity. NMO. Dipping cases. DMO. Velocity spectrum. Deconvolution. Convolution model. Inverse filtering. Minimum phase. Optimum-Wiener filters. Predictive deconvolution. Migration in space and time: Kirchhoff, finite-difference and frequency-wavenumber. Introduction to partial migration before stack. Land and sea acquisition geometry. 3-D seismic data processing. Radon transform and tau-p processing. Hilbert transform and complex trace analysis. AVO. Prerequisite: (S) ZGT 268/3 Exploration Geophysics I **Assessment:** Coursework 30%, Final Examination 70%	Assoc. Prof. Khiruddin Abdullah 04-653 2477 khirudd@usm.my
ZGE 375 Engineering and Environmental Geophysics	2	I	Introduction to environmental and engineering problems as well as geophysicals technique. Relevant physical properties of rocks and soil, seismic reflection: Optimum window and optimum offset techniques. Field procedure, techniques and instrumentation. Data correction and interpretation. Seismic refraction: Interpretation techniques such as GRM and others. Electrical Images: 2D Resistivity Modelling. Finite difference method. 2D electrical imaging exploration and multi electrods. Data collection and interpretation. Introduction to 3D electrical imaging. Relevant topics such as GPR and others. Field examples for environmental, engineering and hydrogeology. Prerequisite: (S) ZGT 268/3 Exploration Geophysics I **Assessment:** Coursework 30%, Final Examination 70%	Mr. Rosli Saad 04-653 3675 rosli@usm.my
ZAE 376 Astronomy Principles and Practices	4	I	The universe at a glance. Spherical trigonometry. Celestial sphere. Celestial coordinate system. Reckoning time. Calendrical systems. Celestial mechanics. Astrometry. Radiation laws. Observation and measurement system. Prerequisite: (S) ZGE 277/4 Structure of the Universe **Assessment:** Coursework 30%, Final Examination 70%	Assoc. Prof. Abdul Halim Abdul Aziz 04-653 5103 abdul@usm.my

Code/Course	Units	Sem	Description	Contact
ZAT 386 Physics of Semiconductors Devices	4	I	Energy band, density of states, intrinsic semiconductor, Electrons and holes conduction, extrinsic semiconductor, impurities, impurity level, Fermi level, carrier concentration, Hall effect; impurity motion; minority carrier life time, recombination process, diffusion length; semiconductor surface, semiconductor-metal contact, semiconductor insulator contact; Ge, Si and III-IV compound; p-n junction devices inclusive of Zener diode, tunnel diod, varactor, variator; single junction transistor; Field effect transistor inclusive of junction FET and metal oxide semiconductor FET (MOSFET), silicon controlled switch (SCS), Shockly diode and phototransistor; solar cell and semiconductor laser. Prerequisite: (S) ZCT 106/3 Electronics I (C) ZCT 307/3 Solid State Physics I **Assessment:** Coursework 30%, Final Examination 70%	Prof. Kamarulazizi Ibrahim 04-653 5113 kamarull@usm.my Assoc. Prof. Azlan Abdul Aziz 04-653 3670 lan@usm.my Assoc. Prof. Md. Roslan Hashim 04-653 5102 roslan@usm.my
ZAT 394 Applied Physics Project and Seminar (two semesters)	6	I	A course which involves projects and seminars. The use of computers would be encouraged where possible. Prerequisite: (P) ZCT 293/2 Physics Practicals III **Assessment:** Coursework 100%	Assoc. Prof. Abdul Halim Abdul Aziz 04-653 5103 abdul@usm.my
ZMT 397 Medical Physics Project (two semesters)	6	I	A course of two semesters duration inclusive of project and seminar. Where applicable, the use of computers is employed in the project embarked. Prerequisites: (S) MAT 181/4 Programming for Scientific Applications and (S) ZMT 298/2 Medical Physics Practical. **Assessment:** Coursework 100%	Assoc. Prof. Mohamad Suhaimi Jaafar 04-653 5104 msj@usm.my
ZGT 395 Geophysics Project (two semesters)	6	I	Project in geophysics or related fields. Prerequisite: (S) ZGT 295/4 Geophysics Practicals **Assessment:** Coursework 100%	Dr. Md. Noordin Abu Bakar 04-653 5106 mnoordin@usm.my
ZKT 396 Engineering Physics Projects	6	I	Consist of a selection of experiments and projects. Prerequisite: (S) ZKT 296/2 Physics Practicals I **Assessment:** Coursework 30%, Final Examination 70%	Assoc. Prof. Md. Roslan Hashim 04-653 5102 roslan@usm.my
ZCT 390 Pure Physics Project	6	I	Project/experiments of related areas of thrust. Prerequisite: (S) ZCT 294/2 Physics Practicals IV **Assessment:** Coursework 100%	Assoc. Prof. Abdul Razak Ibrahim 04-653 5105 arazaki@usm.my

Course	Units	Sem	Synopsis	Lecturer
ZCA 101 Physics I (Mechanics)	4	II	Unit and dimension. Kinematics in one and two dimension. Vectors in physics. Newton's Laws and application. Work and energy. Conservation of energy and momentum. Collision in one and two dimension. Simple harmonic motion. Universal gravitation, gravitional force. Motion of planets. Extended systems, moment of inertia. Angular momentum, rotational dynamics, compound pendulum. Rigid body, equilibrium, statics. Elasticity, stress, strain and torsion. Young's modulus, shear and bulk modulus. Bending of beams, bending moment. Compression of fluids, surface tension, hydrostatics, viscosity, viscoelasticity. Hydrodynamics, continuity equation, Bernoulli equation, Poisseuille equation. Turbulent flow, sedimentation, drags. **Assessment:** Coursework 30%, Final Examination 70%	Dr. Nurhayati Abdullah 04-653 2475 nurhaya@usm.my
ZCA 102 Physics II (Electricity and Magnetism)	4	II	Coulomb's law, electric intensity. Gauss's law, electric flux. Electric potential and electric intensity of point charges, dipole and charge distributions. Capacitance, dielectrics, stored energy. Electric current, resistance, Ohm's law, Kirchhoff's law. Microscopic view of current. D.C. RC circuit. Magnetic fields, Ampere's law, Biot-Savart law. Faraday's law. Lenz's law. Inductance, stored energy, D.C. LR circuit. A.C. current, electric power, RCL circuit. Force on current and moving charge. Lorentz equation, Hall's effect. Dielectric materials, dipole moment, electric polarization. Material resistivity, temperature effect. Electromagnetic waves, electromagnetic spectrum. Magnetic field and electric field vector. Maxwell displacement current, Maxwell equations. **Assessment:** Coursework 30%, Final Examination 70%	Assoc. Prof. Fauziah Sulaiman 04-653 3654 fauziahsulaiman@usm.my
ZCU 100 Energy and The Environment	2	II	Energy and related concepts, history of energy use, sources of energy, energy units and quality of energy. World energy consumption. Consumption of fossil fuels and its effect on the environment. Use of hydropower, nuclear, wind, geothermal, solar and ocean energy as well as biomass and their effects on the environment. Energy situation in Malaysia and her energy policy. Efficient use of energy. Modeling, planning and economics. **Assessment:** Coursework 30%, Final Examination 70%	Dr. Nurhayati Abdullah 04-653 2475 nurhaya@usm.my Dr. Adilah Shariff 04-653 3049 adilah@usm.my
ZCT 103 Physics III (Vibrations, waves and Optics)	3	II	Equation of motion for simple harmonic motion, damped oscillator, forced oscillator. Logarithmic decrement, relaxation time, resonance and Q factor. Coupled oscillations. Transverse waves and longitudinal waves. The wave equation and its solutions. Reflection and transmission of waves at boundaries. Stationary waves. Superposition of waves. Phase velocity and group velocity. Dispersion of waves. Electromagnetic wave spectrum. Plane electromagnetic waves in vacuum. Propagation of light waves, amplitude and intensity. Doppler effect. Interference, Young's double slits, Michelson interferometer. Multiple reflections, thin films, Newtons rings and Fabry-Perot interferometer. Diffraction grating. Dispersion, Cauchy formula. Polarization, Brewster angle. Light sources and light detectors. **Assessment:** Coursework 30%, Final Examination 70%	Dr. Yam Fong Kwong 04-653 3667 yamfk@usm.my

Course	Units	Sem	Description	Contact
ZCT 104 Physics IV (Modern Physics)	3	II	Special Relativity: Reference frames, invariance of Newton's dynamics. Galilean transformation, invariance for other laws. Michelson-Morley experiment. Postulates of special relativity. Lorentz transformation. Relativistic kinematics and dynamics. Einstein formula. Introduction to modern ideas in Physics: Blackbody radiation, Planck's law. Photoelectric effect, Compton effect, X-rays. Wave-particle duality, de Broglie waves. Old atomic models. Alpha-scattering, Rutherford model. Old quantum theory and the Bohr model of the atom. Energy levels of the atom and atomic spectra. Excitation and the Franck-Hertz experiment. Bohr's Correspondence Principle. **Assessment:** Coursework 30%, Final Examination 70%	Dr. Ng Sha Shiong 04-653 3041 shashiong@usm.my
ZCE 111 Computational Physics	4	II	The course aims at training physics students to use computer to do solve realistic physics problems and to provide them with tools and knowledge they can utilize throughout their career in the future. The students shall acquire some ideas of what is possible with computers and what type of tools there are for it to compute real physics problems. This course covers some of the basics of computation, numerical analysis, and programming from a computational science point of view. This will be a practical course focused on application of mathematics and physics using computer than an introductory programming or computer science, with minimal discussion of computer science theory **Assessment:** Coursework 30%, Final Examination 70%	Dr.Yoon Tiem Leong 04-653 3674 tlyoon@usm.my
ZCT 106 Electronics I	3	II	Analysis of circuits. Alternating current circuits. Thevenin's Theorem and Norton's Theorem. Characteristics of diodes and their uses in circuits., rectifying circuits. Signal processing circuits. Bipolar junction transistors and Field effect transistors, input characteristics and output characteristics. Large signal amplifiers, amplification, distortion and frequency response. Power amplifier. Small signal amplifiers and hybrid parameters. Theory of positive and negative feedback. Operational amplifiers and their applications. Prerequisite: (S) ZCA 102/4 Physics II (Electricity and Magnetism) **Assessment:** Coursework 30%, Final Examination 70%	Mr. Low Ah Chuan 04-653 2474 aclow@usm.my
ZGT 162 Geology II	3	II	External geological processes: mechanical and chemical weathering; erosion and deposition by streams, sea and wind; soil profile. Geomorphology: landforms, valleys, drainage patterns, peneplanation; topography of folded and faulted structures. Hydrology: Darcy's law, aquifers, groundwater, artesian wells. Ore deposits: magmatic differentiation, hydrothermal, sedimentary, supergene, lateritic, alluvial. Petroleum geology: formation and migration of petroleum; structural and stratigraphic traps. Geology of Malaysia: general, structural and economic geology. Prerequisite: (S) ZGT 161/3 Geology I **Assessment:** Coursework 30%, Final Examination 70%	Mr. Khairul Arifin Mohd. Noh 04-653 3674 khaiarif@usm.my
ZGT 190 Geology Practicals	2	II	Experiments in geology. Prerequisite: (C) ZGT 161/3 Geology I **Assessment:** Coursework 100%	Mr. Khairul Arifin Mohd. Noh 04-653 3674 khaiarif@usm.my
ZCT 192 Physics Practicals II	2	II	Consist of a selection of experiments. Prerequisite: (S) ZCT 191/2 Physics Practicals I **Assessment:** Coursework 100%	Mr. Ibrahim Mustapha 04-653 3653 mibrahim@usm.my

Code	Units	Semester	Description	Lecturer
ZCT 205 Quantum Mechanics	3	II	Development of Quantum Mechanics: Schrödinger picture and Heisenberg picture. Schrödinger equation. Wave functions. Probability. Measureable quantities. Operators and expectation values. Stationary state. Eigen function and Eigen value. Particle in a box. Harmonic oscillator. Barrier penetration. Central field problem. Hydrogen atom. Prerequisite: (S) ZCT 104/3 Physics IV (Modern Physics) **Assessment:** Coursework 30%, Final Examination 70%	Prof. Fun Hoong Kun 04-653 3652 hkfun@usm.my
ZCT 207 Statistical Mechanics	2	II	Characteristics of macroscopic and microscopic systems. Probability concepts and counting of states. Postulate of equal a priori probabilities. Microcanonical Ensemble. Definition of absolute temperature and entropy. Canonical Ensemble. Statistics of ideal quantum gases. Maxwell-Boltzmann statistics. Bose-Einstein statistics. Fermi-Dirac statistics. Applications of quantum statistics: specific heat of solids, black body radiation, conducting electrons in solids. Prerequisite: (S) ZCT 212/2 Thermodynamics **Assessment:** Coursework 30%, Final Examination 70%	Dr. Yoon Tiem Leong 04-653 3674 tlyoon@usm.my
ZCE 208 Classical Mechanics	2	II	Vector calculus and kinematics. Particle motion, system of particles, conservation laws and examples in Newtonian mechanics such as resistive motion, central force, rocket equation and so on. Motion in non inertial frame systems, Coriolis force. Analytical Mechanics: Calculus of variation, Euler equation. Hamilton's principle and Lagrangian and Hamiltonian dynamics. Generalised coordinates. Lagrange equation. Generalized coordinates. Lagrange multiplier. Hamilton's canonical equation. Prerequite: (P) ZCA 101/4 Physics I (Mechanics) 　　　　　(S) ZCT 210/4 Complex Analysis and Differential Equations 　　　　　(S) ZCT 211/2 Vector Analysis **Assessment:** Coursework 30%, Final Examination 70%	Prof. Rosy Teh Chooi Gim 04-653 3655 Junaidah@usm.my
ZCT 218 Mathematical Methods	3	II	Integral transforms: general properties. Laplace transform: general properties, applications in physical problems. Fourier transform: general properties, applications in physical problems. Special functions/equations: Gamma, Bessel, Legendre and Associated Legendere. Fourier Analysis: expansion of functions in terms of sine and cosine, properties, physical examples. Partial differential equations: Sturm – Lionrille boundary value problems. Wave equation, Heat equation, Laplace equation - solution by separation of variables. Prerequisite: (S) ZCT 210/4 Complex Analysis and Differential Equations 　　　　　(S) ZCT 211E/2 Vector Analysis **Assessment:** Coursework 30%, Final Examination 70%	Dr. Norhaslinda Mohamed Tahrin 04-653 2477 haslinda@usm.my

Code/Course	Unit	Sem	Description	Contact
ZKT 221 Engineering Design	2	II	The aim of this course is to give students on opportunity to experience the process of carrying out a design project. It will thus enable them to appreciate that design involves synthesising parameters which will effect the design solution. The topics to be covered include: (i) Preparing a design specification: Identifying customer requirements (e.g. aesthetics, functions, performance, cost, production parameters); identifying and matching design parameters and resource requirements; extracting design information from appropriate sources; specifying new technologies used; applying relevant standards and legislation. (ii) Preparing a design report: Analying possible design solutions (matrix analysis, brainstorming, mind mapping, forced decision making); evaluating costs & future potential; using check lists & design review procedures; rationale for adopting proposed solution; techniques and media in presentation of a report. (iii) Using computer technology in the design process: Key features of a computer aided design system; softwares and their applications; idectifying limits and constraints. Prerequisite: (S) MAT 181/4 Programming for Science Applications **Assessment:** Coursework 100%	Mr. Wong Chow Jeng 04-653 5107 wongcj@usm.my
ZKT 222 Electronic and Photonic Materials I	3	II	Classes of materials: metals, semiconductors, insulators, single crystals, polycrystals, glasses, ceramics, polymers, bulk materials, thin films, nanostructures. Growth of conducting single crystal material. Thin films growth methods, sputtering, sol-gel, laser ablation, growth of single crystal epitaxial film and multilayers: LPE, VPE, MOCVD, MBE methods. Basic processing of bulk ceramic. Preparation of polymers and glass. Characterization of thin film and bulk material: electrical, diffraction, optical, ion beam microscopy, imaging. Fabrication methods, diffusion, ion implantation, lithography, metallization, dielectric deposition, wet and dry etching Type of junctions. Materials for light emitting diodes. Materials for lasers. Materials for photodetector. Materials for solar cell. Photorefractive materials and holography storage. Photoconductor Prerequisite: (S) ZCT 106/3 Electronics I **Assessment:** Coursework 30%, Final Examination 70%	Assoc. Prof. Md. Roslan Hashim 04-653 5102 roslan@usm.my
ZMT 231 Human Anatomy and Physiology	3	II	Cell structure and function. Homeostasis. Anatomy and Physiology in the following: Respiratory system, Nervous system, Gastro-intestinal system, Cardiovascular system, Endrocrinology, including reproductive system, Muscle and skeletal system, Genito-urinary system. **Assessment:** Coursework 30%, Final Examination 70%	Ms. Siti Fatimah Hussin 04-653 5317 sfh@usm.my Ms. Ernee Sazlinayati Othman 04-653 3668
ZGT 264 Geophysical Data Analysis	2	II	Characteristics of geophysical, meteorological and oceanographic data and special requirements for their analysis. Laplace, Hilbert and Hankel transforms. Dirac delta function. Fourier series. Continuous, discrete and fast Fourier transforms. Power spectra, noise. Correlation, convolution and deconvolution. Basic filters. Basic statistical analysis. Sampling. Applications in geophysics, meteorology and oceanography. Prerequisite: (S) ZCT 210/4 – Complex Analysis & Differential Equations **Assessment:** Coursework 30%, Final Examination 70%	Assoc. Prof. Khiruddin Abdullah 04-653 2477 khirudd@usm.my

ZGT 267 Solid Earth Geophysics II	3	II	The earth and the solar system, Kepler's laws, sunspots, solar flares, prominences, photosphere, chromosphere, corona. Fundamentals of potential field theory. Rotation, gravity field and shape of the earth. Principles of isostasy. Earth tides. Geomagnetism, secular and diurnal variations, dynamo theory, paleomagnetism, rock magnetism. Prerequisite: (S) ZGT 162/3 Geology II **Assessment:** Coursework 30%, Final Examination 70%		Dr. Rosli Saad 04-653 3675 rosli@usm.my
ZGT 269 Exploration Geophysics II	3	II	Theory and practice of potential field methods for geophysical exploration, including the gravity method, the magnetic method and electrical methods. For each method details covered include a description of equipment used, field procedures, nature of data acquired, methods of data processing and interpretation and applications. Prerequisite: (C) ZGT 267/3 Solid Earth Geophysics II **Assessment:** Coursework 30%, Final Examination 70%		Assoc. Prof. Mohd. Nawawi Mohd. Nordin 04-653 2473 mnawawi@usm.my Dr. Syed Mustafizur Rahman 04-653 3675 smrahman@usm.my
ZGT 270 Meteorology II	3	II	Air motion: Coriolis force, gravity effect, pressure gradient, friction, equations of motion, scale analysis. Horizontal flow: geostrophic, thermal, gradient winds, continuity equation. Weather and climate, weather modification, boundary layer. Air pollution meteorology, ozone layer, air-sea interaction. Introduction to numerical modelling. Lightning and biometeorology. Meteorological instrumentation and data acquisition techniques. Weather systems, climatological variability due to winds. Prerequisite: (C) ZCT 218/4 Mathematical Methods (S) ZGT 265/3 Meteorology I **Assessment:** Coursework 30%, Final Examination 70%		Dr. Lim Hwee San 04-653 3663 hslim@usm.my Assoc. Prof . Nasirun Mohd. Saleh 04-653 3715 nasirun@usm.my
ZCE 275 Introduction to Astronomy	4	II	Celestial mechanic. Measurement of time. The Sun and solar system. Structure of the Universe. Astronomical Instrumentation. Other astronomy. Practical. Theory: Celestial sphere, celestial coordinate system, celestial mechanic, ephemerides, star charts. Time and its measurements, calendrical systems. Optical telescopes, mounting, tracking telescope. The Sun and its associated motion, structure of the Sun, its influence on the Earth. The solar system, eclipses. Structure of the universe, stars stellar evolution, H-R diagram, white dwarfs, pulsars, black holes. Galaxy, the Milky Way, evolution, active galaxies, cosmology. Other astronomy - radio, IR, UV, x-ray and gamma ray astronomy. Practical: Understand, handle and observe through optical telescopes. Recognizing stars and constellations. Observe and record celestial objects. Solar observation using filters. Build a simple telescope. Young crescent moon observation. Astrophotography, Image processing. Sky simulation and calculate locations of celestial objects and others. **Assessment:** Coursework 40%, Final Examination 60%		Assoc. Prof. Abdul Halim Abdul Aziz 04-653 2476 abdul@usm.my

Course				Description	Contact
ZAT 281 Introduction to Microprocessors	4	II		Design of microcomputer systems: history and development, architecture, sequential design, and organization. Design of microprocessor systems: internal bus structure, instruction and machine cycles, and instructions flow in CPU. Functions of CPU: ALU, decoder, program counter, instructions register, address data and control registers. Data transfer and timing diagrams. Microprocessor instructions, and assembly language programming. Assemblers and cross assemblers. Interrupts: software and hardware. Interface: memory, input and output port ADC, DAC. Series and parallel ports: RS232, UART/DUART, PIT, buffer, and other peripheral devices. Introduction to current microprocessor systems. Laboratory: Data Input and output, delay subroutine, ADC, DAC. Seven segments or LCD display interface. Controller: DC motor, IR sensor, motor speed, and temperature sensor. Signal generation and transmittance via optical fibres. Prequisite: (P) ZCT 206/3 Electronics I **Assessment:** Coursework 30%, Final Examination 70%	Assoc. Prof. Mohd. Zubir Mat Jafri 04-653 3651 mjafri@usm.my
ZAT 283 Instrumentation	3	II		Instrumentation in industry and laboratory (introduction, survey of instrumentation and types). Transducers (principles, types and applications, for example, pressure, thermal, optical, velocity) and signal conditioning. Introduction to control and feedback with respect to equipment/process. Process control. stability. Noise in instrumentation. Instrumentation reliability. Pressure and vacuum, pumps and gauges. Microscopy: Optical (different modes, e.g. bright/dark field, polarizing, interference, and applications). Electron microscopy and EDX (functions and applications). Spectrophotometer (principles, types and applications for IR, UV and visible). Nuclear radiation detectors and simple systems (units, common detectors, doserate meters). Prerequisite: (S) ZCT 293/2 Physics Practicals III (C) ZCT 206/3 Electronics II **Assessment:** Coursework 30%, Final Examination 70%	Dr. Shahrom Mahmud 04-653 4110 shahromx@usm.my
ZCT 294 Physics Practicals IV	2	II		Consist of a selection of experiments. Prerequisite: (S) ZCT 293/2 Physics Practicals III **Assessment:** Coursework 100%	Assoc. Prof. Abdul Razak Ibrahim 04-653 5105 arazaki@usm.my
ZGT 295 Geophysics Practicals (two semesters)	4	II		Experiments in geophysics and Geophysical Field Camp. Prerequisite: (S) ZGT 190/2 Geology Practicals **Assessment:** Coursework 100%	Mr. Rosli Saad 04-653 3675 rosli@usm.my

ZKT 296 Photonics Laboratory	6	II	Selected experiments in photonics Prerequisite: (S) ZCT 293/2 Physics Practicals III **Assessment:** Coursework 100%	👤 Assoc. Prof. Md. Roslan Hashim 📞 04-653 5102 🖱 roslan@usm.my 👤 Assoc. Prof. Azlan Abdul Aziz 📞 04-653 3670 🖱 lan@usm.my 👤 Mr. Wong Chow Jeng 📞 04-653 5107 🖱 wongcj@usm.my 👤 Dr. Khalid Mutashar Omar 📞 04-653 3673 🖱 khalhadithi@usm.my 👤 Dr. Magdy Hussien Mourad Mohamed 📞 04-653 3654 🖱 mhussien@usm.my
ZMT 298 Medical Physics Practical	2	II	Consist of a set of selected experiments. Prerequisite: (S) ZCT 293/2 Physics Practical III **Assessment:** Coursework 100%	👤 Assoc. Prof. Mohamad Suhaimi Jaafar 📞 04-653 5104 🖱 msj@usm.my
ZGE 361 Advanced Geology	2	II	Depositional environments; sedimentary facies. Facies models: alluvial fan, fluvial plain, sandy desert, lake, coast, delta, glacier, terrigenous shelf, carbonate shelf, continental slope, continental rise, basin plain, subducting plate margin, oceanic ridge and oceanic basin. Stratigraphic framework and structural styles in petroleum exploration. Basin analysis. Prerequisite: (S) ZGT 162/3 Geology II **Assessment:** Coursework 30%, Final Examination 70%	👤 Dr. Rosli Saad 📞 04-653 3675 🖱 rosli@usm.my 👤 Mr. Khairul Arifin Mohd. Noh 📞 04-653 3674 🖱 khaiarif@usm.my

ZCT 304 Electricity and Magnetism	3	II	Revision of vector analysis, vector calculus, basic theorems, curvilinear coordinates, and Dirac-delta function. The Coulomb Law. Electric fields, E. Divergence of E. The Gauss'Law. Curl of E. Gradient of E and electrical potential, V. Electrical dipoles. The Poisson's and Laplace's equations. Electrostatics field in dielectric medium. The Gauss' law for dielectric. Displacement vectors. Polarization. Electric susceptibility and dielectric constant. Electrical boundary conditions. Electrical potential energy for dielectric medium.
			
			Magnetic fields. The Bio-Savart's law. Divergence of B. Magnetic potential vector, A. Curl of B. The Ampere's circuit law. Magnetic dipoles. Electromagnetic induction. The Faraday's induction laws. Magnetic materials. The Maxwell's equations. Polarization of electric fields. The Poynting theorem. Electromagnetic boundary conditions. Propagation of electromagnetic waves in free space. Propagation of electromagnetic waves in material medium.
			
			Prerequisite: (P) ZCA 102/4 Physics II (Electricity and Magnetism)
			      (S) ZCT 210/4 Complex Analysis and Differential Equations
			      (S) ZCT 211/2 Vector Analysis
			
			Assessment:
			Coursework 30%,
			Final Examination 70%
				👤 Dr. Wong Khai Meng
				📞 04-653 3678
				🖱 kmwong@usm.my

ZKE 324 Display and Storage	2	II	Video output technique. TV line format. Text display. Dot matrix display. Segment display. LED. Vacume fluorescence display (VFD). Electroluminescience display. Colour CRT. Monochrome CRT. Plasma display. Display resolution. Lyquid crystal devices: physics and applications. Electro-optical effect used in liquid crystal displays (LCD). Multiplexing capability and optical memory of liquid crystal cells and basic properties for applications in high information contentscreens. Supertwist liquid crystal screens, active matrix addressing LCD, ferroelectric LCD. Plasma fluycies, Polymer disflay Electron beam storage. Bubble and charge coupled memories. Cassettes. Semiconductor storage. Electromagnetic storage. Optical tape storage. Optical disc storage. Quantum storage. Data storages: Hard disk, floppy disk, CD and DVD. Prerequisite: (S) ZCT 213/2 Optics **Assessment:** Coursework 30%, Final Examination 70%	Dr. Magdy Hussien Mourad Mohamed 04-653 3654 mhussien@usm.my
ZKE 325 Optical Fibre Technology and Communication	4	II	History of the optical fibre. Electromagnetic wave in optical fibre and optical fibre material. Total internal reflection. Acceptance angle and cone. Characteristics of optical fibre; numerical aperture, mode, V-number, attenuation, dispersion, and bandwidth. Choosing of Wavelength. A variety of different fibre and their advantages; single mode, multimode, step index, graded index, and other profiles. Optical fibre design and fabrication. Preform fabrication; MCVD, PCVD, OVD, and VAD. Fibre drawing system and manufacturing of various optical cables. Advantageous and disadvantageous of plastic optical fibre (POF). Characteristics and fabrication of rare earth doped optical fibre. Principles and operation of wave guide, interferometer, coupler, modulator, splicer, switch, and some optical sensors. Characteristics and fabrication of rare earth doped optical fabre. Polarization maintorining fibres. Fundamental of optical communication. Wave guides and wave guide devices. Wave division multiplexing (WDM). Transmitters in optical communication: LED and laser diode, Fabry-Perot laser, and distributed feedback laser diode. Reciever for optical signals. Theory and operation of optical connectors. Optical connection and launching losses. Structure and operation of optical modulator such as $LiNbO3$ and Mach-Zehnder interferometer. Theory and operation of optical amplifier: semiconductor and rare earth doped optical amplifier. Optical communication system and architecture; transmitter, receiver, modulator, amplifier, repeaters, optical fibre medium, multiplexing, and demultiplex. Fiber optic system design and troublesshooting. Information transmission: Modulation methods (AM, FM, PCM) multiplexing methods (TDM,FDM, WDM), data rate, noise ratio, bandwidth, bit error, repeaters, analysis of optical power budget, and system rise time. Optical communication networks system. Prerequisite: (S) ZCT 213/3 Optics (C) ZCT 304E/3 Electricity and Magnetism **Assessment:** Coursework 30%, Final Examination 70%	Mr. Wong Chow Jeng 04-653 3679 wongcj@usm.my

Course	Units	Sem	Description	Contact
ZKE 326 Signal and Image Processing	4	II	Digital image and signal processing system; processors, digitizer, digital computer, storage, display, scanner. Sampling and quantization; image geometry, frequency domain, image and signal transformations: Fourier transform, discrete Fourier transform, 2-D Fourier transform, Laplace transform, convolution, fast Fourier transform, Walsh transorm, discrete cosine transform, Hotelly transform and Hough transform. Signal detection in frequency domain, power spectrum, filters. Encoding, different pulse code modulation. Image enhancement, histogramming, smoothing, sharpening, thresholding, edge detection, spatial mask, linking. Image representation and description. Industrial vision system; automated visual inspection, process control and assembly application. Holografhy Prerequisite: (C) ZCT 218/3 Mathematical Methods **Assessment:** Coursework 30%, Final Examination 70%	Dr. Magdy Hussien Mourad Mohamed 04-653 3654 mhussien@usm.my
ZMT 334 Physics of Diagnostic Radiology	3	II	X-ray tube and generators. X-ray spectrum. Interaction of X-rays in human body. Scattering radiation. Film-screen radiography. Fluoroscopy, tomography, mammography. Digital radiography. Quality control and testing of radiographic X-ray machine. Film image quality: contrast, resolution. MTF. Radiation hazards associated with diagnostic radiology. Current developments in diagnostic radiology. Prerequisite: (S) ZCT 104/3 Physics IV (Modern Physics) **Assessment:** Coursework 30%, Final Examination 70%	Assoc. Prof. Mohamad Suhaimi Jaafar msj@usm.my Ms. Siti Fatimah Hussin sfh@usm.my 04-653 5104
ZMT 335 Physics of Radiotherapy and Nuclear Medicine	3	II	Introduction to radiotherapy. Radiobiology basics for radiotherapy. Isodose curves, depth dose, field size, Corrections for body inhomogeneities and tissue curvature. Radiotherapy equipment. Characteristics of Co-60 machines and linear accelerators. Brachytherapy. Quality control. Safety aspects of treatment room design. Current developments in radiotherapy. Basic physics in radionuclide imaging. Principle of tracers in nuclear medicine. Ideal characteristics of radioactive agents for diagnosis. Ideal characteristics of radioactive agents for therapy. Rectilinear scanners. Gamma cameras. Technetium generator. Internal dosimetry. Prerequisite: (S) ZCT 104E/3 Physics IV (Modern Physics) **Assessment:** Coursework 30%, Final Examination 70%	Ms. Siti Fatimah Hussin 04-653 5317 sfh@usm.my Ms. Ernee Sazlinayati Othman 04-653 3668

ZCE 341 Energy Studies	4	II	Renewable energy and types of renewable energy. Sources of renewable energy. Energy from solar. Introduction to bioenergy. Biomass as fuel. Types of biomass. Conversion proses: direct combustion, gasification, fermentation and pyrolysis. Main product of each conversion process: heat, bio-gas, alcohol and bio-oil. Production evolution and solar energy availability. Types of solar power technology. Principles of solar cell operation. Material and response of silicon solar cell. Sunlight concentration. Solar cells array. Array protection and failure sensor. Power conditioning. Energy storage and connection to grid. Photovoltaic power economy. Understanding wind power. How does wind machine work. Production of wind power. Introduction to geothermal power. Types of geothermal source, electricity generation from geothermal power. Understanding hydro power. How does hydro power work. Advantage and disadvantage of hydro power. Reading. Prerequisite: (S) ZCT 106/3 Electronics I **Assessment:** Coursework 30%, Final Examination 70%	Dr. Adilah Shariff 04-653 3049 adilah@usm.my
ZGE 364 Tropical Meteorology and Forecasting	3	II	Introduction; radiation processes in the tropics (the input and energy received at the earth's surface). Circulation in the tropics, the ITCZ, trade-wind inversion, cumulus convection. Tropical disturbances, their structures and theories according to different regions: the tropical cyclone, warm low pressure, squalls, tornado, Hadley circulation, the easterly waves. Equatorial atmospheric features: equatorial waves, Kelvin waves, mixed Rossby-gravity waves. Analysis of synoptic charts in the tropics (streamlines, isotach and satellite images). Tropical scalar analysis (continuity equation). Theory: barotropic instability, barotropic-baroclinic instability, instability of the first, second kinds, CISK, parcel and slice methods. The flow features, structure of the monsoon waves. Interaction and variability of the monsoon and its relationship with the higher latitudes (north and south). Disturbances over peninsular Malaysia. Short and long range forecasting (statistics and numerical modelling). Prerequisite: (S) ZGT 270 Meteorology II **Assessment:** Coursework 30%, Final Examination 70%	Assoc. Prof. Nasirun Mohd. Saleh 04-653 3715 nasirun@usm.my
ZGE 373 Seismic Data Processing	3	II	Basic mathematics for Fourier Transform. Aliasing and phase considerations. Operations in the time domain and frequency domain. Preprocessing. Main processing sequence. Velocity analysis. Factors that influence velocity. NMO. Dipping cases. DMO. Velocity spectrum. Deconvolution. Convolution model. Inverse filtering. Minimum phase. Optimum-Wiener filters. Predictive deconvolution. Migration in space and time: Kirchhoff, finite-difference and frequency-wavenumber. Introduction to partial migration before stack. Land and sea acquisition geometry. 3-D seismic data processing. Radon transform and tau-p processing. Hilbert transform and complex trace analysis. AVO. Prerequisite: (S) ZGT 268/3 Exploration Geophysics I **Assessment:** Coursework 30%, Final Examination 70%	Assoc. Prof. Khiruddin Abdullah 04-653 2477 khirudd@usm.my Dr. Syed Mustafizur Rahman 04-653 3675 smrahman@usm.my
ZGE 379 Geological Oceanography	4	II	Sources of sediments, grain size, grain size analysis and environmental interpretation of grain size. Properties of fluid flow, sediment movement, sediment transport rate. Bedforms and internal structures. Origin and morphology of ocean basins and margins. Beach, salt marsh and estuarine sedimentation. Sources, composition and types of deep-sea sediments. Patterns of deep-sea sedimentation. Effects of sea-level changes. Nature of hydrothermal circulation. Resources from the ocean floor. Prerequisite: (C) ZGT 272/3 Introduction to Oceanography **Assessment:** Coursework 30%, Final Examination 70%	Dr. Md. Noordin Abu Bakar 04-653 5106 mnoordin@usm.my

ZAE 384 Laser Technology and Its Application	4	II	Introduction to properties of lasers. Basic principle of laser. Stimulated emission. Laser pumping. Oscillator. Laser output. Modifying laser output. Laser expositions. Holography and applications. Optical communications Laser induced fluorescence. LIDAR and pollution control. Industrial uses of lasers. Medical applications. Laser classifications and safety. Prerequisite: (S) ZCT 104/3 Physics IV (Modern Physics) **Assessment:** Coursework 30%, Final Examination 70%	Dr. Khalid Mutashar Omar 04-653 3673 khalhadithi@usm.my
ZAT 387 Semiconductor Fabrication Processes	4	II	Growth of semiconductor ingot, preparation and characterization of wafer, oxidation and lithography process. Diffusion of dopant and creation of junction. Metallization. Characterization of junction, example junction depth, etc. Thin film techniques, integrated circuit development, bonding and packaging. Prerequisite: (S) ZAT 386/4 Physics of Semiconductor Devices **Assessment:** Coursework 30%, Final Examination 70%	Assoc. Prof Azlan Abd. Aziz 04-653 3670 lan@usm.my
ZAE 388 Non-Destructive Testing	4	II	Introduction. Visual testing. Pressure and leak testing. Liquid penetrant inspection. Thermal methods. Industrial radiography (example: X-ray radiography). Ultrasonics. Dynamic testing. Electromagnetic methods (examples: magnetic-particle, electric-particle and eddy current methods). Thickness measurements. Other techniques: e.g. spot tests, spectro-chemical analysis, activation analysis, electrographic printing, EDX, sulphur printing, spark testing, surface analysis, electron probe. Prerequisite: (S) ZCT 104/3 Physics IV (Modern Physics) **Assessment:** Coursework 30%, Final Examination 70%	Dr. Mutharasu Devarajan 04-653 3041 mutharasu@usm.my
ZAT 389 Low Dimensional Semiconductor Structure	3	II	Basic Introduction. One dimensional band structure. Energy band gap. Motions of an electron in a band structure. Band structure in two dimensions. Semiconductor crystal structure. Alloy semiconductors band structure. Point defects in semiconductor crystals. Metal-Semiconductor Interface Introduction. Schottky barrier. Ohmic contact. Metal-Oxide-Semiconductor (MOS) structures. Heterostructures General characteristics of heterostructures. Growth of heterostructures. Band engineering. Quantum wells and barriers. Conduction band characteristics. Doped heterostructures. Stressed layers. Electron in Quantum Structures Square well with infinite depth. Square well with finite depth. Parabolic well. Triangular well. Low dimensional systems. Confinement in lower dimensions. Quantum wells in heterostructures. Optical Properties of Quantum Wells Golden Rule. Optical absorption. Absorption between bands. Absorption in a quantum well. Transition between bands in a quantum well. Transition between subbands in a quantum well. Prerequisite: (S)ZCT 307/3 Solid State Physics I **Assessment:** Coursework 30%, Final Examination 70%	Assoc. Prof. Haslan Abu Hassan 04-653 3200 haslan@usm.my

ZAT 394 Applied Physics Project and Seminar (two semesters)	6	II	A course which involves projects and seminars. The use of computers would be encouraged where possible. Prerequisite: (P) ZCT 293/2 Physics Practicals III **Assessment:** Coursework 100%	Assoc. Prof. Abdul Halim Abdul Aziz 04-653 5103 abdul@usm.my
ZMT 397 Medical Physics Project two semesters)	6	II	A course of two semesters duration inclusive of project and seminar. Where applicable, the use of computers is employed in the project embarked. Prerequisites: (S) MAT 181/4 Programming for Scientific Applications (S) ZMT 298/2 Medical Physics Practical. **Assessment:** Coursework 100%	Assoc. Prof. Mohamad Suhaimi Jaafar 04-653 5104 msj@usm.my
ZGT 395 Geophysics Project (two semesters)	6	II	Project in geophysics or related fields. Prerequisite: (S) ZGT 295/4 Geophysics Practicals **Assessment:** Coursework 100%	Dr. Md. Noordin Abu Bakar 04-653 5106 mnoordin@usm.my
ZKT 396 Engineering Physics Projects	6	II	Consist of a selection of experiments and projects. Prerequisite: (S) ZKT 296/2 Physics Practicals I **Assessment:** Coursework 100%	Assoc. Prof. Md. Roslan Hashim 04-653 5102 roslan@usm.my
ZCT 390 Pure Physics Project	6	II	Project/experiments of related areas of thrust. Prerequisite: (S) ZCT 294/2 Physics Practicals IV **Assessment:** Coursework 100%	Assoc. Prof. Abdul Razak Ibrahim 04-653 5105 arazaki@usm.my
ZCT 317 Solid State Physics II	3	II	Phonon; neutron scattering, thermal conductivity, anharmonic effect. Electron energy band in solids, Fermi surface. Electron dynamics in magnetic field, cyclotron resonance, Hall effect. Superconductivity. Dielectric and optical properties. Ferro-electrics. Magnetic properties. Properties of amorphous materials. Prerequisite: (S) ZCT 307/3 Solid State Physics I **Assessment:** Coursework 100%	Assoc. Prof. Abdul Razak Ibrahim 04-653 5105 arazaki@usm.my

Course Code/ Title	Unit	Semester Offered	Synopsis	Details of Lecturer
SAU 213E Gender, Ideology and Power	4	II	Gender differences which began in traditional society continues to expand in modern industrial society. This mirrors the imbalance "development" between men and women. The course will look into the roots, causes and processes that contributed to this imbalance "development". Among the topics that will be discussed are: development and women, labour process and women involvement in the labour force, violence against women, the relations between public and domestic spheres of life, and women involvement in political and societal organisations. **Assessment:** Coursework 40%, Final Examination 60%	Dr. Ong Beng Kok 04-653 4613 ongbengkok@usm.my
SAU 216E Globalization, Cyber Culture and Future Studies	4	II	Based on the current wave of globalisation, this course focuses on issues relating to globalisation and cyber culture. The analyses offered by this course are based on the premise that social inequality cannot be fully understood without a critical discussion of the global factors and processes interacting with it. Digital divide is also, therefore, examined within this larger social context, whereby digital divide itself can be seen as a manifestation of inequality within a group of societies wired by a network of information. Among the questions posed are: Are the processes of globalisation and the digital revolution benefiting certain groups of people, while marginalizing the rest? What are the factors contributing towards this phenomenon? Is globalisation or the digital revolution democratising power and giving opportunities to people to engage in fair competition? The course also exposes students to the literature on the impact of globalisation on local societies. Particular emphasis is given to identifying and understanding the whole range of perspectives about structures, processes and forces of globalisation as well as cyber culture that include the different sociological dimensions within society. This course will help students to independently and critically evaluate these various perspectives, including pessimistic and optimistic ones. During the course of the lectures, tutorials and assignments, students will be given the opportunity to formulate their own paradigms and derive their own conclusions about globalisation and cyber culture. **Assessment:** Coursework 60%, Final Examination 40%	Dr. Reevany Bustami 04-653 3351 reevany@usm.my
SAU 218E Economic Sociology	4	I	The course encompasses economic actions, relations, and processes within their social settings and is different from economics, which deals with economic behaviour per se. The course reviews changes in how various social science disciplines have explained the economy, and then zeroes in on the sociological approach. The course draws attention to the fundamental premise that a deep understanding of the economy requires attention to how social structure and institutions shape information flow, trust, cooperation, norms, morality, power and domination, in economic action and interaction. The course analyzes economic phenomena such as markets, corporations, society, networks, religions, ethnicity, gender, values, environment, and the role of the state in the economy by using the tools of sociology. It shares economists' attention to the role of interests and rationality, but also emphasizes the importance of social relations and social institutions. **Assessment:** Coursework 40%, Final Examination 60%	Assoc Prof. Chin Yee Whah 04-653 5069 ywchin@usm.my

SAU 300E Work and Life	4	II	This course will help students to get an overview on the sociological approach in understanding work in modern society. It looks at the basic concepts and theories in sociology of work. It looks at the changes which are happening in work organizations and how it affects work. Among the questions which will be addressed in this course are: What is work? What are the changes which are happening in work and work organizations? How are occupational choice made? What are the changes that are expected to happen to work in the future? **Assessment:** Coursework 40%, Final Examination 60%	Dr. K. Premalatha 04-653 4619 prema@usm.my
SAU 305E Crime and Criminal Behavior	4	II	This course provides an introduction to concepts, theories, methodology and research in the field of Criminology. Special focus will be given to concepts and measurements as well as theoretical explanations of crime and criminal behaviour. The patterns, causes and effects of criminal behaviour in various socio-cultural, economic, ecological and political contexts will also be examined. In addition, this course will focus on various concepts, theories and critical issues related to policing, courts, penology and rehabilitation, and victimology. A special effort will be made to compare western criminological theories and its application to crime and criminal behaviour in Malaysia. **Assessment:** Coursework 40%, Final Examination 60%	Assoc. Prof. P. Sundramoorthy 04-653 3352 moorthy@usm.my
SBU 213E Issues of Urbanization	4	II	This course attempts to explore the issues that emerge out of the process of urbanization. Main issues for discussion include food supply, housing, industrialisation and transportation. We will look at selected theories of urbanisation and compare Malaysia's experience of urbanisation with other countries. **Assessment:** Coursework 40%, Final Examination 60%	Ms. Zainab Wahidin 04-653 4623 wzainab@usm.my
SBU 304E Environment, Natural Resources and Development	4	I	The objective of the course is to expose students with issues pertaining to the environment and development. Students of development studies are faced by a dynamic and changing world, particularly influenced by global and regional trends. The environmental crisis is one of the examples of changes that they should be aware of in order to fulfill their duty of serving the common good. It is important for them to understand the issues related to the environment as more legislation is introduced to curb and control environmental problems. The understanding of environmental concepts can minimize adverse environmental effects as a result of their direct decision-makings and also enhance their accountability and responsiveness to contemporary problems and answer the needs and aspirations of the mass population. Other objectives include – providing students with theoretical concepts related to sustainable development; providing students with the insights and knowledge of the issues related to environment and development; exposing students with the tools used in environmental policy, such as EIA and; promoting a more environmentally aware and sensitive students. The course is divided into 3 main parts. The first part is about the political economy of the environment, which will provide the students with essential introduction to familiarize and acquire insights and knowledge concerning the global issues and problems, related to environment and development. This section also includes brief glances to the different environmental school of thoughts. The second part of the course provided a comprehensive discussion related to development and environment. This includes urban issues (industrial, housing, transportation, recycling, and etc.) and rural issues (agriculture, rainforest, and etc.). Providing some important insights into environmental policy concludes the course. This includes the theory and application of Environmental Impact Assessment (EIA); Green accounting and environmental values methods and their applicability in real policy-making. **Assessment:** Coursework 40%, Final Examination 60%	Dr. Salfarina Abd. Gapor 04-653 2665 farina@usm.my

SBU 325E Industrialization and International Development	4	I	This course examines comparative industrialisation processes to explain why and how different countries have taken different paths to industrialisation and yet remaining integrated within the same international system. Development experiences of both developed and newly industrialising countries will be taken into account. **Assessment:** Coursework 40%, Final Examination 60%	Ms. Zainab Wahidin 04-653 4623 wzainab@usm.my
SBU 344E Land Development and Administration	4	I	This course provides a general overview on the land administration system and land development process particularly in the Malaysian context. The objectives are to introduce the students to the various concepts and issues pertaining to land development and land administration, and to foster awareness about the importance of land to human population and development. This course is structured into two parts. The first part introduces the land administration system and various land laws in Malaysia, the development planning process and the government's role in regulating land development efforts in the country. The second part explores in detail several issues related to land development from the economic, social and environmental points of views. Among the critical issues include land ownership, the impact of land development on the society and its natural environment, urban land management and sustainable land use. **Assessment:** Coursework 40 %, Final Examination 60%	Dr. Nor Malina Malek 04-653 3361 malina@usm.my
SEA 205E Malaysian Studies	4	I & II	This course investigates the structure of the Malaysian system of government and the major trends in contemporary Malaysia. Emphasis will be given both to current issues in Malaysian politics and the historical and economic developments and trends of the country. The discussion begins with a review of the independence process. An analysis of the formation and workings of the major institutions of government - parliament, judiciary, bureaucracy; the electoral and party systems will follow this. The scope and extent of Malaysian democracy will be considered, especially in the light of current changes and developments in Malaysian politics. The second part of the course focuses on specific issues: ethnic relations, national unity and the national ideology; development and political change; federal-state relations; the role of religion in Malaysian politics; politics and business; Malaysia in the modern world system; civil society; law, justice and order; and directions for the future. Topics to include: - Introduction and Overview of the Course - Independence and Nation Building in Malaysia - Institutions of Government: Constitution, Parliament, Judiciary and the Executive - Government and Democracy - Law, Justice, and Order - Political Parties and Elections (Ethnic Relations and the Problems of National Unity) - The Evolving Class Structure in Malaysia - Politics and Business - Political Development and Change in Sabah and Sarawak - Religion in Malaysia - Women in Malaysia - Minorities and the Indigenous People of Malaysia - Malaysia in the Modern World System **Assessment:** Coursework 40%, Final Examination 60%	Dr. Azeem Fazwan Ahmad Farouk 04-653 4604 azeemf@usm.my

SEA 301 Politics and Regionalism in ASEAN	4	I	The course examines politics in the Southeast Asian region and the emergence of the Association of Southeast Asian Nations (ASEAN) as arguably the most important regional grouping in contemporary Asian history. The instructor will first introduce students to the period of political turbulence during the Cold War, marked by the Vietnam War and the involvement of major powers in the region. Regional alliances and other politico-military formations will be briefly reviewed, before an analysis of the establishment and development of ASEAN as a "pluralistic security community" is examined. The course will examine ASEAN's role in fashioning the regional order that has obtained since the end of the Cold War. Some focus will be given to watershed events in the region's politics, for example, the Cambodian conflict and peace process, the East Timor issue and the Spratly Islands question. Particular attention will be paid to new regional arrangements for security such as the ASEAN Regional Forum. Finally, an examination will be made of the limits of ASEAN regionalism and the problem of engendering strong civil societies within ASEAN and would-be ASEAN states. **Assessment:** Coursework 40%, Final Examination 60%	👤 Dr. Soon Chuan Yean 📞 04-653 3345 🖱 chuanyean@usm.my
SEA 302 Economic Transformation in Southeast Asia	4	I & II	The course is designed to present a macro dynamic picture of the economic transformation of the ASEAN countries, such as Brunei, Indonesia, Malaysia, the Philippines, Singapore and Thailand. Emphasis is on understanding the development in economic policies, trade regimes, the role of public sector, human resource development, technology transfer, foreign direct investment and the industrialisation process. This course will also examine selected contemporary economic issues confronting the ASEAN countries. Topics to be discussed are: Macroeconomic Structure An overview of ASEAN economic structure, output, employment, inflation, income distribution and trade. Industrialisation process of Southeast Asia The basis for industrialisation, comparative advantage, the role of government in policy and planning, technology transfer, foreign direct investment, saving, resource mobilisation, trends and prospects. Aspects of Human Resource Development Importance of human resource development, labour mobility and migration, poverty and income inequality, and investment in human capital. Public Sector The changing roles of public and private sectors, public expenditure and revenue. Regional Trade Trade composition, inter-regional and intra-regional trade, regional co-operation and interdependence, market liberalisation and competition. Selected Contemporary Issues In this section, the coverage will be limited to two most relevant topics. These topics are external debt problems, capital flows, regional imbalances within a country, technology transfer and exchange rates stability. **Assessment:** Coursework 40%, Final Examination 60%	👤 Prof. Dato' Jamalludin Sulaiman 📞 04-653 4618 🖱 jamals@usm.my 👤 Dr. Chua Soo Yean 📞 04-653 3350 🖱 sychua@usm.my

Course	Units	Sem	Description	Contact
SEA 303 Societies and Culture of the Nusantara	4	II	The course provides students with a new learning experience of the historic evolution, continuity and transformation of living and performing arts and heritage in Southeast Asia. It analyses innovations in art and heritage by demonstrating the eclectic fusion and unique separation of ideas between indigenous and extraneous Asiatic and European colonial/post-colonial influences, founded in cultural contact and communication. The role of religion, ideology and economics in influencing the spread pattern, form and content of art and heritage will also be analysed with the ultimate view of developing a comprehensive perspective of the dominant Southeast Asian experience of unifying the arts and sciences in all spheres of life, to ensure the development of a 'total life experience' in individuals and society. Topics to be discussed are: - Indigenous arts and heritage forms influenced by naturalistic and animistic worldviews in traditional and contemporary life situations. - Influences from the great traditions of China, India and Muslim Asia. - Colonial and postcolonial encounters with Southeast Asian art and heritage and themes of integration, eclecticism and separation. - Conservation, preservation and promotion of art and heritage as an integral part of human ecology, both material and spiritual. - Southeast Asian distinctiveness in the unity of science and culture, art and technology and the development of a total life-experience in individuals and society. - Tourism and cultural development of the arts and heritage. **Assessment:** Coursework 40%, Final Examination 60%	Dr. Nor Hafizah Selamat 04-653 4608 hafiz@usm.my
SEA 306 Independent Studies	4	I & II	This course is offered to cater to students interested in focussing on a specific area of Southeast Asian studies. The student will be assigned to a faculty member who possesses appropriate expertise to supervise and evaluate the student's work. The supervisor concerned would determine the mode of evaluation, although the student is generally expected to produce a semester-end paper or bibliographical essay or both. **Assessment:** Coursework 100%	04-653 3369 ddsa_soc@usm.my
SEU 322E Applied Economics	4	II	The course discusses topics, which have not been covered at the second year level. The analysis is more detailed and it emphasises the application of economic concepts in the real world. This course also aims to prepare students for the graduate level. The topics are divided into 4 broad themes: (i) Advanced Consumer Choice Theory, (ii) Risk and Asymmetric Information, (iii) Economics of Time, and (iv) Game Theory and Strategic Behaviour. **Assessment:** Coursework 30%, Final Examination 70%	Dr. Loke Yiing Jia 04-653 4615 yjloke@usm.my
SEU 323E Monetary Economics	4	I	This course introduces the student to the basic principles of money, the conduct of monetary policy and monetary theories. There are three broad sections in this course. Firstly, students are introduced to the overview of the financial system, then the concept of money and interest rates in the economy. Secondly, the demand of money and the supply of money are discussed. Thirdly, the course looks at the mechanics involved in developing monetary policy and its implications to the economy. **Assessment:** Coursework 30%, Final Examination 70%	Dr. Loke Yiing Jia 04-653 4615 yjloke@usm.my
SEU 325E Economic Planning and Project Analysis	4	II	The course discusses the role of planning and public policy in economic development, planning theories and techniques. The course will also touch on certain issues in the execution and administration of economic planning. **Assessment:** Coursework 40%, Final Examination 60%	Prof. Dato' Jamalludin Sulaiman 04-653 4618 jamals@usm.my Dr. Saidatulakmal Mohd. 04-653 4622 eieydda@usm.my

Course	Units	Sem	Description	Contact
SEU 327E Agriculture Marketing Economics and Corperative	4	II	This course will be a comprehensive study of issues related to agricultural prices and marketing with special reference to Malaysian agricultural marketing problems. The concepts of markets, marketing, demand, marketing margin, efficiency, costs, marketing functions and services, price formation and movement, Cobweb model, price index and measurement, parity prices and price elasticity will be discussed. Also included and discussed in the course are issues related to government price and marketing programmes such as LPN, LTN and FAMA, marketing problems of subsistence, small-scale farmers including co-operatives and farmers' organisations, bargaining and marketing boards. **Assessment:** Coursework 30%, Final Examination 70%	Prof. Amir H. Baharuddin 04-653 3348 amirhb@usm.my
SEU 329E Public Sector Economics	4	I	This course focuses on an economic analysis of public sector expenditure and taxation. Topics discussed include the importance of the public sector; the economic rationale for the public sector; provision of goods and services by the public sector; other forms of market intervention by the public sector; social choice; public sector expenditure in Malaysia; the Malaysian tax structure; the welfare cost of taxation; and tax incidence (partial and general equilibrium analysis). **Assessment:** Coursework 30%, Final Examination 70%	Dr. Saidatulakmal Mohd. 04-653 4622 eieydda@usm.my
SEU 330E International Trade	4	I	The earlier part of the course discusses topics pertaining to a free trade system, namely (i) comparative advantage, (ii) structure of international trade, and (iii) terms of trade. The second part of the course discusses the impact of various trade barriers. Finally, the course analyses the impact of growth on international trade and the Third World trade conditions. Main topics of the syllabus are: theories of absolute and comparative advantages; Heckscher-Ohlin Theory; modern trade theories; tariff and non-tariff issues; custom unions; growth and its impact on international trade **Assessment:** Coursework 40%, Final Examination 60%	Dr. Chua Soo Yean 04-653 3350 sychua@usm.my
SEU 331E International Finance	4	II	Topics covered by the course are divided into four parts. The first part covers balance of payments accounts and accounting, meaning of balance and imbalance, and Malaysia's balance of payments accounts. The second part covers the types of foreign exchange markets (spot, forward, futures and options) and foreign exchange rates (nominal, real, nominal effective and real effective exchange rates), arbitrage, hedging, speculation, and interest arbitrage, and theories on exchange rate determination. The third part analyses the various adjustments and solutions to balance of payments problems under different exchange rate regimes, the relationship between external trade and the national economy through the trade multiplier and exchange rate policies. Finally, the fourth part of the course covers the fixed versus flexible exchange rates debate, the appropriate choice of exchange rate regime, the optimum currency block, the past and present international monetary systems, the European monetary system, the World Bank and the International Monetary Fund, international macroeconomic policy coordination, international currency crises and other current international financial issues. **Assessment:** Coursework 40%, Final Examination 60%	Dr. Normee Che Sab 04-653 2654 csnormee@usm.my
SPU 207E Foundations of Public Policy	4	II	While social problems are getting more complicated, political science students are expected to understand how the government is trying to manage these problems through public policies. This course offers the students an understanding of the policy process and the challenges encountered in this process. Students will analyse the process of policy-making, including the implementation, monitoring and evaluation of policy. This will be achieved through a theoretical perspective of the policy formulation process and the application of these concepts in an analysis of policy issues in Malaysia. **Assessment:** Coursework 40%, Final Examination 60%	Prof. Ahmad Atory Hussain 04-653 2798 ahmadatory@usm.my

Course	Units	Semester	Description	Contact
SPU 311E Third World Ideologies	4	II	This course aims to enhance students' understanding of political concepts and development approaches in the "Third World" or countries of the "South" in their efforts to navigate with "independent" political ideologies. **Assessment:** Coursework 40%, Final Examination 60%	Assoc. Prof. Latif Kamaluddin 04-653 2662 kalatif@usm.my
SPU 314E International Politics and Regional Cooperation	4	I	The focus of this course is the approach of Peace Studies and conflict resolution at the international level. A few problems and conflicts at the international level will be looked at in great detail including the Arab-Israel conflict, the Gulf War, the Cambodian conflict, the conflict in the Balkans, ethnic conflict and the militarisation of the world. The course will also look at the United Nations as well as regional organisations and their roles in conflict resolution in order to preserve international peace. **Assessment:** Coursework 40%, Final Examination 60%	Dr. Zainal Abidin Sanusi 04-653 4606 zainals@usm.my
SPU 315E Public Sector Management	4	I	This course provides students with an overview to the study of the public sector from a management perspective. A comprehensive examination of the public sector in terms of its organizational functions, capacities and constraints is undertaken. This is followed by discussions on public sector reforms, their rationale and an assessment of the reforms' effectiveness at enhancing the provision and delivery of public services. Finally, the course will also look into the challenges faced by the public sector as posed by the relentless tide of globalisation, advancing technologies, as well as social, political and economic factors, both at the domestic and international levels. **Assessment:** Coursework 40%, Final Examination 60%	Dr. Noreha Hashim 04-653 3358 noreha@usm.my
SPU 318E Democratic Government	4	I	This introductory course aims at exposing students to concepts, institutions and processes of democratic government. It begins with a critical survey of the basic idea and approach to democracy as found in ancient Greece. This is followed by a survey of the development and practice of the democratic ideal in Western Europe and its spread to countries of the Third World, including Muslim and Asian societies. The course will examine the rise of authoritarian regimes in Asia and their compatibility with democracy. The course ends with a critical evaluation of democratic governance in the era of globalisation and a discussion of its future. **Assessment:** Coursework 40%, Final Examination 60%	Dr. Azeem Fazwan Ahmad Farouk 04-653 4604 azeemf@usm.my

Course Code/ Title	Unit	Semester Offered	Synopsis	Details of Lecturer
EKC 107 Organic Chemistry	3	I	This course deals with important organic chemical processes and industrial chemical reactions. Typical reactions like hydrogenation, esterification/ transesterification, oxidation and polymerization will be described with emphasis on compounds and reactions of industrial importance. Some experiments will be carried out which focus on synthesis of basic organic chemical products to reinforce the theory. **Assessment:** Coursework 40%, Final Examination 60%	Assoc. Prof. Mashitah Mat Don 04-599 6468 chmashitah@eng.usm.my Assoc. Prof. Sharif Hussein Sharif Zein 04-599 6442 chhussein@eng.usm.my
EKC 157 Chemical Engineering Drawing	2	I	The student will be exposed to the basic concepts of standard Engineering Drawing and the application of conventional signs, symbols, lettering, geometry, instrument needed, types of orthographic and isometric presentation including piping system. It also exposes students to application of AUTOCAD and PROCEDE software in engineering process drawing. **Assessment:** Coursework 100%	Assoc. Prof. Ridzuan Zakaria 04-599 6420 chduan@eng.usm.my Assoc. Prof. Mohd. Roslee Othman 04-599 6426 chroslee@eng.usm.my
EKC 212 Fluid Flow for Chemical Engineering	4	I	This course will cover the basic principles of fluid transport including the phenomena of fluid and theories related to fluid static, incompressible fluid and compressible fluid. The student will also expose to mass and energy balances of fluid flow in conduits, transportation and metering of fluids, fluidization and flow past immersed bodies as well as agitation and mixing of liquids. **Assessment:** Coursework 40%, Final Examination: 60%	Prof. Abdul Latif Ahmad 04-599 6400 chlatif@eng.usm.my Dr. Mohd. Azmier Ahmad 04-599 6459 chazmier@eng.usm.my Dr. Ooi Boon Seng 04-599 6418 chobs@eng.usm.my

EKC 214 Energy Balance	3	I	This course provides knowledge on the principles and application of the energy balance in chemical process industry. Students will be introduced to the forms of energy, tables of thermodynamics, concept of latent heats and energy balance for non-reactive and reactive processes. Application of Microsoft Excel for solving energy balance problems will also be introduced as well as having industrial talk for industrial exposure. **Assessment:** Coursework 40%, Final Examination 60%	Dr. Suhairi Abdul Sata 04-599 6461 chhairi@eng.usm.my Dr. Derek Chan Juinn Chieh 04-599 6414 ch_derekchan@eng.usm.my
EKC 217 Mass Transfer	3	I	Students are introduced to the theories of diffusion and mass transfer. Basic principles of unit operations such as distillation, absorption and extraction are covered. **Assessment:** Coursework 40%, Final Examination 60%	Dr. Lee Keat Teong 04-599 6467 chktlee@eng.usm.my Dr. Khairiah Abd. Karim 04-599 6421 chkhairiah@eng.usm.my
EKC 244 Computer Programming and Application	4	I	The course introduces the use of MATLAB in problem solving in engineering with a special emphasis on basic calculations in chemical engineering. It covers arrays, which are the basic building blocks in MATLAB; file usage, built in math functions, and user defined functions; programming using branch and loop constructs; 2-D and 3-D plots, and fitting data to models. Other tools such as Microsoft Excel will be used as well as MATLAB for solving linear and nonlinear equations and function optimization. This course will also provide student with the knowledge of process simulation in chemical engineering design using software. This course also guide students through the key steps in process simulation modeling for chemical processes in which the students will gain hands-on experience on the techniques to troubleshoot common simulation problems. **Assessment:** Coursework 100%	Assoc. Prof. Ridzuan Zakaria 04-599 6420 chduan@eng.usm.my Dr. Syamsul Rizal Abd Shukor 04-599 6402 chsyamrizal@eng.usm.my
EKC 271 Biotechnology for Engineering	3	I	This course provides an overview of the fundamental concepts in Biotechnology which are pertinent to Engineering and technology. Primary topics include: Cell, cell metabolic pathways, microbial growth kinetics both batch and continuous system, sterilization and enzyme kinetics. **Assessment:** Coursework 40%, Final Examination 60%	Assoc. Prof. Mashitah Mat Don 04-599 6468 chmashitah@eng.usm.my Dr. Mohamad Hekarl Uzir 04-599 6464 chhekarl@eng.usm.my
EKC 313 Separation Processes	3	I	To introduce the theory of humidification and separation processes to the students. This includes mass transfer and the design criteria of processes such as drying, crystallization, adsorption, humidification, filtration, membrane processes and supercritical fluid extraction. **Assessment:** Coursework 40%, Final Examination 60%	Assoc. Prof. W. J. Noel Fernando 04-599 6428 chnoel@eng.usm.my Mr. Azam Taufik Mohd. Din 04-599 6466 chazam@eng.usm.my

EKC 336 Chemical Reaction Engineering	3	I	This course contains knowledge on the principles of homogeneous reaction kinetics, reaction equilibria, isothermal and non-isothermal, ideal, non-ideal, adiabatic, non-adiabatic reactor design. **Assessment:** Coursework 40%, Final Examination 60%	Assoc. Prof. Sharif Hussein Sharif Zein 04-599 6442 chhussein@eng.usm.my Dr. Tye Ching Thian 04-599 6471 chcttye@eng.usm.my
EKC 361 Process Dynamics and Control	4	I	This course will provide the knowledge of process dynamics and control in chemical engineering processes. It covers the concept of theoretical model, dynamic behavior of open and closed-loop systems, basic type of controllers, PID controller tuning procedures and controller stability criterion. This course also introduces enhanced single loop control strategies and basic process instrumentation. **Assessment:** Coursework 40%, Final Examination 60%	Assoc. Prof. Norashid Aziz 04-599 6411 chnaziz@eng.usm.my Dr. Suhairi Abdul Sata 04-599 6461 chhairi@eng.usm.my
EKC 375 Enviromental Engineering and Management	4	I	This course introduces the current environmental laws and the essential elements of environmental engineering and management. This includes introduction to environmental management system ISO140001, wastewater treatment, air pollution control, solid waste and hazardous waste management, 3R concept and waste minimization. **Assessment:** Coursework 40%, Final Examination 60%	Dr. Vel Murugan Vadivelu 04-599 6460 chvel@eng.usm.my Dr. Tan Soon Huat 04-599 6475 chshtan@eng.usm.my
EKC 451 Process Design and Analysis	4	I	To introduce the preliminary design of chemical process plant to the students. This includes process creation and analysis, synthesis of separation trains, heat and power integration and process equipment design. ASPEN PLUS II will be implemented through out the course in the process flow sheeting and equipment design. **Assessment:** Coursework 100%	Prof. Subhash Bhatia 04-599 6409 chbhatia@eng.usm.my Dr. Zainal Ahmad 04-599 6461 chzahmad@eng.usm.my
EKC 474 Industrial Effulent Engineering	3	I	This course contains physical, chemical, advanced and biological treatment of wastewater including design, operation, analysis and troubleshooting of treatment plant. In addition it also deals with treatment, reuse and disposal of solids and bio-solids produced during wastewater treatment processes. **Assessment:** Coursework 40%, Final Examination 60%	Assoc. Prof. Ahmad Zuhairi Abdullah 04-599 6411 chzuhairi@eng.usm.my Dr. Vel Murugan Vadivelu 04-599 6460 chvel@eng.usm.my

EKC 483 Petroleum and Gas Processing Engineering	3	I	The students will be able to understand the operations of downstream processing units of petroleum refining plant and natural gas treating processes. The student will learn about crude oil and petroleum products properties and specifications. The student will gain knowledge about the operation of petroleum refinery and natural gas processing units **Assessment:** Coursework 40%, Final Examination 60%	Prof. Bassim H. Hameed 04-599 6422 chbassim@eng.usm.my Dr. Tye Ching Thian 04-599 6471 chcttye@eng.usm.my
EKC 493 Chemical Engineering Laboratary III	2	I	This course covers experiments on chemical reactions, mass transfer, heat transfer, separation processes, process control and environmental treatment. The experiments are: Air Pressure System, Air Flow System. Air Temperature System. Boiler Drum and Heat Exchanger – Pilot Plant 1, Boiler Drum and Heat Exchanger – Pilot Plant 2, pH Control (Pilot Plant). Heat Exchanger Control. pH Control (Bench). Level and Flow Control (Bench). Level Transmitter Calibration and Level Dynamics. Coagulation and Flocculation, Sedimentation, PM10, Continuous Stirred Tank Reactor, Filter Press, Plug Flow Reactor, Heavy Metal Removal, Aeration Unit Solid Handling. **Assessment:** Coursework 100%	Mr. Azam Taufik Mohd. Din 04-599 6466 chazam@eng.usm.my
EKC 108 Physical and Analytical Chemistry	4	II	This course will give the students the basic concept of First and Second Law of Thermodynamics. This will include perception of concept on heat, work, internal energy, enthalpy and entropy. The basic concept of solution behaviour will also be introduced including ideal and non ideal solutions as well as the electrochemical systems. In addition this course is also devoted to the fundamentals of qualitative and quantitative measurements with emphasis on spectrometry, common analytical equipment like UV/Vis, GC, HPLC and AAS. There will be a 4 hrs laboratory demonstration on the analytical equipment. **Assessment:** Coursework 40%, Final Examination: 60%	Assoc. Prof. Mashitah Mat Don 04-599 6468 chmashitah@eng.usm.my Assoc. Prof. Sharif Hussein Sharif Zein 04-599 6442 chhussein@eng.usm.my
EKC 111 Mass Balance	3	II	This course is an introduction to the analysis of chemical processes with an emphasis on mass balances. Topics include an introduction to flow chart for the chemical industry, concepts of recycle, bypass and purge in mass balances for reactive and non-reactive systems. MS EXCEL is used to solve mass balance problems in chemical processes. **Assessment:** Coursework 40%, Final Examination 60%	Prof. Abdul Latif Ahmad 04-599 6400 chlatif@eng.usm.my Dr. Syamsul Rizal Abd. Shukor 04-599 6402 chsyamrizal@eng.usm.my Dr. Suhairi Abdul Sata 04-599 6461 chhairi@eng.usm.my

Course	Unit	Sem	Description	Contact
EKC 216 Process Heat Transfer	3	II	This course involves the introduction of different modes of heat transfer. The principles and basic calculations of heat transfer by conduction, convection and radiation will be covered. Heat exchange equipment such as heat exchangers are also included. **Assessment:** Coursework 40%, Final Examination 60%	Assoc. Prof. Mohd. Roslee Othman 04-599 6426 chroslee@eng.usm.my Dr. Mohd. Azmier Ahmad 04-599 6459 chazmier@eng.usm.my
EKC 222 Chemical Engineering Thermodynamics	3	II	This course introduces the concepts of chemical engineering thermodynamics including laws of thermodynamics, volumetric and thermodynamic properties of fluids, thermodynamics properties of fluids, thermodynamics applications, .refrigeration and liquefaction, solution thermodynamics, **Assessment:** Coursework 40%, Final Examination 60%	Assoc. Prof. Ridzuan Zakaria 04-599 6420 chduan@eng.usm.my Dr. Lim Jit Kang 04-599 6423 chjitkangl@eng.usm.my
EKC 245 Mathematical Methods for Chemical Engineering	3	II	This course will provide the knowledge of various numerical techniques in solving chemical engineering problems. Students will be introduced to error analysis, optimization techniques and numerical methods to solve Ordinary and Partial Differential Equations. Application of MATLAB and Microsoft Excel for solving numerical problems. **Assessment:** Coursework 40%, Final Examination 60%	Dr. Tye Ching Thian 04-599 6471 chcttye@eng.usm.my Dr. Suhairi Abdul Sata 04-599 6461 chhairi@eng.usm.my
EKC 291 Chemical Engineering Laboratory I	2	II	This course would be an application of heat transfer and fluid Flow through executing 20 Pilot Plant experiments in Unit Operation Laboratory which are related to chemical engineering principles. **Assessment:** Coursework 100%	Mr. Azam Taufik Mohd. Din 04-599 6466 chazam@eng.usm.my
EKC 314 Transport Phenomena	3	II	The course contributes primarily to the student's knowledge of transport processes in chemical engineering by providing molecular level understanding of transport processes and establishing the modeling tools (mathematics and physics) to predict macroscopic behavior of real systems. This course develops the skills and tools needed for engineering practice, especially for extension of new models to new systems. The course describes the underlying physical processes involved in transport of momentum, heat and mass. This information supports the empirical models for transport parameters widely used in many unit operations analyses. **Assessment:** Coursework 40%, Final Examination 60%	Assoc. Prof. W. J. Noel Fernando 04-599 6428 chnoel@eng.usm.my Dr. Derek Chan Juinn Chieh 04-599 6414 ch_derekchan@eng.usm.my Dr. Mohamad Hekarl Uzir 04-599 6464 chhekarl@eng.usm.my

EKC 337 Analysis Reactor and Design	3	II	The student will be exposed to design conventional catalytic, multiphase reactors and bioreactors. Sufficient knowledge on the preparation and characterization of different types of catalyts needed for industrial processes will also be given. **Assessment:** Coursework 40%, Final Examination 60%	Assoc. Prof. Ahmad Zuhairi Abdullah 04-599 6411 chzuhairi@eng.usm.my Dr. Mohamad Hekarl Uzir 04-599 6464 chhekarl@eng.usm.my
EKC 367 Plant Safety	3	II	This course provides the principles knowledge related to safety in chemical and process industries. It covers to the introduction of safety concept, industrial hygiene, characteristic of major hazards, derivation of mathematical model related to leakages and dispersion. Students will be also taught hazard identification and risk assessment techniques. And finally the use of safety concept in designing chemical plant to produce Inherently Safer Plant. **Assessment:** Coursework 40%, Final Examination 60%	Assoc. Prof. Mohamad Zailani Abu Bakar 04-599 6419 chmohdz@eng.usm.my Dr. Tan Soon Huat 04-599 6475 chshtan@eng.usm.my Mr. Azam Taufik Mohd. Din 04-599 6466 chazam@eng.usm.my
EKC 376 Downstream Processing of Biochemical and Pharmaceutical Products	3	II	This course gives an overview of possibilities and problems typically associated with the recovery of biochemical and pharmaceutical products. It focuses on the concentration, recovery and isolation of the biological molecules relevant in biochemical and pharmaceutical industries. The principles, advantages and limitations of centrifugation, membranes, cell disruption, two-phase extraction, precipitation crystallization and chromatography are discussed. The integration of bioseparation schemes will be emphasized with specific applications. **Assessment:** Coursework 40%, Final Examination 60%	Dr. Ooi Boon Seng 04-599 6418 chobs@eng.usm.my Dr. Tan Soon Huat 04-599 6475 chshtan@eng.usm.my Dr. Khairiah Abd. Karim 04-599 6421 chkhairiah@eng.usm.my
EKC 377 Renewable and Alternative Energies	3	II	This course will cover with the issues of renewable energy and alternative energy sources. The sustainable energy will include biomass utilization and conversion technologies, solar energy generation including energy collection, storage, and its applications, Photovoltaic, wind farms and collection devices and geothermal energy production and technology. The alternative energy will include fuel cell performances, types of fuel cells, fuel cell systems, basic thermodynamics and heat/mass transfer in fuel cell systems, biofuel production from bioresources; hydrogen based technologies including storage of hydrogen. The course will analyze in terms of cost benefit, energy solutions and cost comparison. The analysis will be project based and will provide solution in terms of nature of energy, its resources, energy conservation and efficiency. The economic and environmental effects of energy use will be included. **Assessment:** Coursework 40%, Final Examination 60%	Dr. Lee Keat Teong 04-599 6467 chktlee@eng.usm.my Dr. Vel Murugan Vadivelu 04-599 6460 chvel@eng.usm.my

EKC 394 Chemical Eng. Lab. II	2	II	This course would be an application of heat transfer, mass transfer and combined heat and mass transfer through executing experiments in Unit Operation Laboratory which is related to chemical engineering principles. The course also covers the experiments related to environment and petroleum product analysis. **Assessment:** Coursework 100%	Assoc. Prof. Mohd. Roslee Othman 04-599 6426 chroslee@eng.usm.my
EKC 453 Plant Design and Economics	4	II	The course utilizes the knowledge gained by the student's in earlier courses and applies in the complete design of a Chemical Process Plant. The plant design includes cost estimation, profitability analysis, piping and instrumentation, plant wide control, waste management and life cycle assessment, plant safety, operability and reliability, plant layout, plant startup, commissioning and shutdown. ASPEN PLUS II will be implemented throughout the course in the chemical process plant design and economic analysis. **Assessment:** Coursework 100%	Prof. Subhash Bhatia 04-599 6409 chbhatia@eng.usm.my Dr. Zainal Ahmad 04-599 6403 chzahmad@eng.usm.my
EKC 462 Advanced Control System for Industrial Process	3	II	This course will introduce the concepts of advanced control strategies, multi-loop and multi-variable control as well as model-based control strategies. This course will also introduce the control concepts for systems with large dead time. **Assessment:** Coursework 40%, Final Examination 60%	Dr. Zainal Ahmad 04-599 6403 chzahmad@eng.usm.my Assoc. Prof. Norashid Aziz 04-599 6411 chnaziz@eng.usm.my
EKC 499 Final Year project	6	II	This course provides the platform for carrying out individual research on specific areas in chemical engineering. This project involves literature survey, theoretical analysis, computer modelling and/or design of experiment, also development of experimental setup, data analysis and presentation of results in terms of oral and written report. **Assessment:** Coursework 100%	Assoc. Prof. Ridzuan Zakaria 04-599 6420 chduan@eng.usm.my

Course Code/ Title	Unit	Semester Offered	Synopsis	Details of Lecturer
EAA 204 Structure and Strength of Materials Laboratory	2	I	Tensile test on mild steel; Combined action of bending and torsion; Shear and bending moment test; Asymmetrically loaded cantilever beam test; Bending of beam test, Tests on cement, Physical characteristics of aggregates, Mechanical characteristics of coarse aggregate. **Assessment:** Coursework 100%	Dr. Norazura Muhammad Bunnori 04-599 6259 cenorazura@eng.usm.my Assoc. Prof. Megat Azmi Megat Johari 04-599 6208 cemamj@eng.usm.my
EAH 221 Fluid Mechanics for Civil Engineers	3	I	Introduction to fluid properties and characteristics, static fluid, forces in fluid, fluid kinematics, continuity equation and its application, momentum equation and its application, Bernoulli and energy equation and their application, boundary layers, lift and drag forces and their application, flow measurement. **Assessment:** Coursework 30%, Final Examination 70%	Assoc. Prof. Ismail Abustan 04-599 6251 ceismail@eng.usm.my
EUP 222 Engineeris in Society	3	I	Engineering ethics: meaning of ethics, importance of ethics, principles of ethics, required ethical behavior, code of engineering ethics, responsibilities of professional engineer, professional behavior. Basics of law for engineers: introduction to Malaysian legal system, law of contract, law of agency, law of tort, industrial law, intellectual property law, corruption law. Financial accounting: introduction to accounting, recording accounting information, trial balance, basics of financial statements, accounts adjustments, interpreting accounting information, financial statement analysis. Basics of management: introduction to management theories, planning, organizing, leading, controlling, management function. **Assessment:** Coursework 40%, Final Examination 60%	Dr. Farid Ezanee Mohamad Ghazali 04-599 6222 cefarid@eng.usm.my
EAS 253 Theory of Structures	3	I	This course concentrates on the analysis of statically indeterminate structures. The course content includes; Concept of statical determinacy; Energy method for deflection in beams and frames; Force method for the analysis of statically indeterminate trusses, beams and frames; Displacement method for the analysis of statically indeterminate beams and frames; Plastic analysis and Influence Lines of Statically Indeterminate Beams. **Assessment:** Coursework 30%, Final Examination 70%	Assoc. Prof. Taksiah A. Majid 04-599 6282 taksiah@eng.usm.my Assoc. Prof. Choong Kok Keong 04-599 6225 cekkc@eng.usm.my

Code	Unit		Synopsis	Lecturer
EAK 263 Geomatic Engineering	4	I	Introduction to engineering geomatic; Concepts of control in geomatic engineering: vertical controls, horizontal control, and detail surveying. Analysis of observation, theory of errors, geomatic computations, methods of booking and plotting of plans. Vertical Control: Principles of leveling and its applications, types and construction of levels, types of instrument adjustments, types of leveling procedures. Contouring and cross-sections. Horizontal control: Principles of theodolite and its application, types and construction of theodolite, types of instrument adjustment, traversing and linear measurement, methods of booking, computation and error analysis, and coordinate systems. Detailing: Types of detailing techniques, tachometric surveying; principles and methods of tachometric measurement, detailing and booking, accuracy, types of errors, plotting methods. Earthworks: Methods of calculating area of cross-sections, volume and mass-haul diagram. This course comprises field survey works to expose to the students the main field geomatic engineering works associated with the engineering practice. **Assessment:** Coursework 40%, Final Examination 60%	Assoc. Prof. Wan Muhd. Aminuddin Wan Hussin 04-599 6211 cewan@eng.usm.my Assoc. Prof. Mohd. Sanusi S. Ahamad 04-599 6224 cesanusi@eng.usm.my
EUP 301 Engineering Management	3	I	Human resources management: Human Resources Planning, Selection and Recruitment, Training and Organizational Development, Wage and Salary Management, Health and Safety, Industrial Relations, Motivation, Stress Management. Marketing management: Marketing Dimensions, Buyers Behavior, Strategy Development in Industrial Market, Product Planning, Pricing Policy, Globalization. Engineering economics: Introduction to Engineering Economics, The goals of a firm, demand and supply, Inflation and unemployment, Role of Government and Money Management, Introduction To E-Commerce and K-Economy, Economic Analysis – substitution, finance and project analysis, Economic Decisions- estimation and forecasting. **Assessment:** Coursework 40%, Final Examination 60%	Dr. Farid Ezanee Mohamad Ghazali 04-599 6222 cefarid@eng.usm.my
EAA 305 Hydraulics, Geotechnical & Engineering Laboratory	2	I	Introduction to laboratory practices and experiments. To familiarize the students with the use of various testing equipment and enable them to conduct sample testing. **Assessment :** Coursework 100%	Mr. Muhd. Harris Ramli 04-599 6217 cemhr@eng.usm.my Dr. Syafalni 04-5996291 cesyafalni@eng.usm.my
EAP 313 Waste Water Engineering	2	I	Introduction to wastewater; quality, flow and waste loading, sewer design, type of domestic wastewater treatment plant, physical treatment, biological treatment, wastewater pumping, sludge removal **Assessment:** Coursework 40%, Final Examination 60%	Prof. Hamidi Abdul Aziz 04-599 6200 cehamidi@eng.usm.my

Course			Description	Contact
EAL 334 Highway Engineering	4	I	Introduction: road network, geotechnical aspects, route location, drainage. Highway materials: aggregate, binders. Bituminous materials: types, design, production. Pavement design: flexible, rigid, comparison. Construction: flexible and rigid pavements. Pavement maintenance: program and methods. Highway safety devices: pavement markings, road signs, lighting, safety fences to enhance traffic safety. **Assessment:** Coursework 30%, Final Examination 70%	Prof. Meor Othman Hamzah 04-599 6210 cemeor@eng.usm.my Dr. Leong Lee Vien 04-599 6286 celeong@eng.usm.my Dr. Joewono Prasetijo 04-599 6290 cejoewono@eng.usm.my
EAG 345 Geotechnical Analysis	3	I	Geotechnical theories and analyses covering Shear Strength, Slope Stability, Lateral Earth Pressure, Retaining Walls, Shallow Foundations, and Deep Foundations. Introduction to site investigation, sampling, and field tests. **Assessment:** Coursework 40%, Final Examination 60%	Assoc. Prof. Fauziah Ahmad 04-599 6268 cefahmad@eng.usm.my Assoc. Prof. Ir. Mohamad Razip Selamat 04-599 6214 cemrs@eng.usm.my
EAS 353 Reinforced Concrete Structural Design I	3	I	This course will cover the introduction design for reinforced concrete structures focusing on cross-section design, shear, bond and torsion design, limitation in deflection and cracking, detailing design in the first part. The second part will deal with beam design, one way and two slab design, column, shallow foundation and staircase. Code of practice such as BS 8110 Pt. 1, Part 2, Part 3, BS 4466 and BS 6399 Pt. 1 will be used as references. **Assessment:** Coursework 50%, Final Examination 50%	Assoc. Prof. Badorul Hisham Abu Bakar 04-599 6203 cebad@eng.usm.my Dr. Fatimah De'nan 04-599 6271 ceftimah@eng.usm.my Assoc. Prof. Ir. Md. Azlin Md Said 04-599 6202 azlin@eng.usm.my Mr. Shaharudin Shah Zaini 04-599 6221 shaharudin@eng.usm.my
EAA 371 Industrial Trainning	5	I	The training is designed to strike a balance between the development of skills and an appreciation of civil engineering processes. Training programs requires application of knowledge at an intellectual level to match their ongoing academic activities. The goal of this program is to train students to be professional engineers and helping them to be more competitive in the world marketplace. **Assessment :** Coursework 100%	Dr. J. Jayaprakash 04-599 5517 jaypee@eng.usm.my

Course				Synopsis	Lecturer
EAA 384 Construction Technology	2	I		Drawing and specifications for construction work, conventional and modular types of building construction, construction materials, earth work, building foundation, construction of building, building infrastructure, drainage system, water supply, waste water. **Assessment:** Coursework 40%, Final Examination 60%	Assoc. Prof. Megat Azmi Megat Johari 04-599 6208 cemamj@eng.usm.my Dr. Norazura Muhammad Bonnuri 04-599 6259 cenorazura@eng.usm.my Dr. J. Jayaprakash 04-599 5517 jaypee@eng.usm.my
EAP 411 EIA & Soil Waste Management	3	I		Solid Waste Management; What is solid waste, engineering principles, treatment of solid waste, ultimate disposal. Environmental Impact assessment (EIA; Introduction; Application of EIA in Malaysia; Preparation of report and case study. Environmental Management Plan; Introduction, preparation of report and case study. **Assessment:** Coursework 40%, Final Examination 60%	Dr. Mohd. Suffian Yusoff 04-599 6223 suffian@eng.usm.my Assoc. Prof. Nor Azam Ramli 04-599 6227/6260 ceazam@eng.usm.my
EAH 416 River Conservation & Rehabilitation	2	I		Natural river characteristics, Problems and Opportunities, River Conservation, River Rehabilitation **Assessment:** Coursework 100%	Mr. Zorkeflee Abu Hassan 04-599 5875 redac04@eng.usm.my Dr. Lai Sai Hin 04-599 5874 redaclai@eng.usm.my
EAH 422 Advanced Water Resources Engineering	4	I		Water resources development planning, storm water management, cross-drainage design, river design and irrigation system. **Assessment:** Coursework 40%, Final Examination 60%	Assoc. Prof. Ismail Abustan 04-599 6251 ceismail@eng.usm.my Assoc. Prof. Ir. Md. Azlin Md. Said 04-599 6202 azlin@eng.usm.my Assoc. Prof. Rozi Abdullah 04-599 6281 cerozi@eng.usm.my

Course	Credit	Sem	Description	Lecturer
EAG 442 Advanced Geotechnical Engineering	4	I	Advance geotechnical studies covering rock mechanics, reinforced earth and ground improvements **Assessment:** Coursework 40%, Final Examination 60%	Assoc. Prof. Fauziah Ahmad 04-599 6268 cefahmad@eng.usm.my Assoc. Prof. Mohamad Razip Selamat 04-599 6214 cemrs@eng.usm.my Assoc. Prof. Molla Mohamad Ali 04-599 6289 cemmali@eng.usm.my
EAA 455 Reinforced Concrete Structural Design II	2	I	Introduction to deep foundation, Structural capacity of bored and micro piles, Pile capacity check, Introduction to pile cap design, Flat slab design, Retaining wall and basement design, Introduction to Pre-stressed concrete structures. **Assessment:** Coursework 40%, Final Examination 60%	Assoc. Prof. Badorul Hisham Abu Bakar 04-599 6203 cebad@eng.usm.my Assoc. Prof. Ir. Md. Azlin Md. Said 04-599 6202 azlin@eng.usm.my Mr. Shaharudin Shah Zaini 04-599 6221 shaharudin@eng.usm.my
EAK 465 Geographical Information System	2	II	Introduction to Geographic Information System (GIS); database management system. Spatial analysis and data collation. Remote Sensing technology; satellite image processing and its application in civil engineering. Integrated remote sensing and GIS technology. Development of spatial decision support system. Laboratory sessions on software application in spatial data analysis and processing **Assessment:** Coursework 40%, Final Examination 60%	Assoc. Prof. Wan Muhd. Aminuddin Wan Hussin 04-599 6211 cewan@eng.usm.my Assoc. Prof. Mohd. Sanusi S. Ahamad 04-599 6224 cesanusi@eng.usm.my
EAA 483 Construction Management	2	I	Construction Management for Civil Engineering includes: Contract Management, Project Management; Planning technique; Value Engineering; Quality assurance; and Safety and Health in Construction. **Assessment :** Coursework 40%, Final Examination 60%	Assoc. Prof. Ir. Md. Azlin Md. Said 04-599 6202 azlin@eng.usm.my Dr. Farid Ezanee Mohamad Ghazali 04-599 6222 cefarid@eng.usm.my

EAA 492 Final Year Project	6	I & II	An individual project is required, which may involve research and development work, engineering design, literature survey, experimental work, theoretical work, computational studies, simulation, and implementation. Students will be assigned an individual research and development project, and a typed and bound thesis on the project should be submitted at a date to be determined by the Faculty **Assessment :** Coursework 100%	Assoc. Prof. Taksiah A. Majid 04-599 6282 taksiah@eng.usm.my
EAA 493 Integrated Design Project	3	I	Integrate knowledge in planning, design and construction; Preparing the students competency in engineering practices; Provide substantial engineering project and focus and refer to professional standards and manuals; Preparation of a complete report describe civil engineering processes and provide recommendation and draw conclusions; Build up "bridging" to civil engineering professionalism; Provide opportunity of personal creativity and initiative. **Assessment:** Coursework 100%	Assoc. Prof. Ir. Mohamad Razip Selamat 04-599 6214 cemrs@eng.usm.my
EUM 112 Theory of Structures	4	II	Introduction to matrix algebra, numerical methods, complex numbers and applied probability and statistics. Some applications in engineering field. **Assessment :** Coursework 30% Final Examination 70%	Assoc. Prof. Ahmad Shukri Yahya 04-599 6270 shukri@eng.usm.my Dr. Joewono Prasetijo 04-599 6290 cejoewono@eng.usm.my
EAS 152 Strength of Materials	3	II	Concept of stress and strain: Normal stress and strain (Tension and compression), shear stress and strain and bearing stress; Axially loaded bars: forces in bars and elongation, concept of statical indeterminacy, introduction to design of bars; Torsionally loaded circular bars: torsional moment in bars and angle of twist, introduction to torsion of thin-walled sections; Laterally loaded beams: Shear force and bending moment and stresses in beams (normal stress due to bending and shear stress), Introduction to design of beam; Deflection: Double integration method for beam deflection; Stress and strain analysis: Concept of bi-axial stress, major and principal stresses, Use of Mohr's circle; Columns: Concept of critical load (buckling load), Euler formula, effective length, effect of eccentric load and introduction to column design **Assessment:** Coursework 30%, Final Examination 70%	Assoc. Prof. Choong Kok Keong 04-599 6225 cekkc@eng.usm.my Assoc. Prof. Molla Mohamad Ali 04-599 6289 cemmali@eng.usm.my Dr. Fatimah De'nan 04-599 6271 cefatimah@eng.usm.my
EAS 181 Concrete Technology	2	II	Introduction to concrete; component materials for concrete (cement, aggregates, water, chemical admixtures, mineral admixtures); properties of materials, tests on materials; production processes of concrete, tests on fresh concrete; concrete mix design; tests on hardened concrete, properties of hardened concrete, strength, deformation, durability. **Assessment:** Coursework 30%, Final Examination 70%	Assoc. Prof. Megat Azmi Megat Johari 04-599 6208 cemamj@eng.usm.my Dr. J. Jayaprakash 04-599 5517 jaypee@eng.usm.my

Course	Unit	Sem	Description	Lecturer
EAA 110 Civil Engineering Drawing	2	II	An introduction in graphical engineering which cover graphical technique and technical drawing principle in order preparing civil engineering drawing. Computer usage in drawing and detailing, Basic CAD practices, Basic AutoCAD usage. **Assessment:** Coursework 100%	Assoc. Prof. Mohd. Sanusi S. Ahamad 04-599 6224 cesanusi@eng.usm.my Mr. Muhd. Harris Ramli 04-599 6217 cemhr@eng.usm.my
EAA 203 Concrete, Structure & Fluid Mechanics Laboratory	2	II	Curved Bar and Continuous Beam, Sag and Tension in Cable, Deflection of Strut, Influence Line of Beam's Deflection, Three Hinged Arch, Force and Strain in Pin Jointed Frame; Concrete Mix Design and Tests on Concrete; Flow Through Orifice and Calibration of Notch, Bernoulli Theorem, Reynolds number, Bourdon Gauge **Assessment :** Coursework 100%	Dr. J. Jayaprakash 04-599 5517 jaypee@eng.usm.my Dr. Fatimah De'nan 04-599 6271 cefatimah@eng.usm.my Dr. Syafalni 04-599 6291 cesyafalni@eng.usm.my
EUP 222 Engineers in Society	3	II	Engineering ethics: meaning of ethics, importance of ethics, principles of ethics, required ethical behavior, code of engineering ethics, responsibilities of professional engineer, professional behavior. Basics of law for engineers: introduction to Malaysian legal system, law of contract, law of agency, law of tort, industrial law, intellectual property law, corruption law. Financial accounting: introduction to accounting, recording accounting information, trial balance, basics of financial statements, accounts adjustments, interpreting accounting information, financial statement analysis. Basics of management: introduction to management theories, planning, organizing, leading, controlling, management function. **Assessment:** Coursework 40%, Final Examination 60%	Dr. Farid Ezanee Mohamad Ghazali 04-599 6222 cefarid@eng.usm.my
EUM 213 Operational Research	3	II	Introduction to operational research. Solving linear programming problems using graphical technique, the M method, the two phase method and the dual simplex method. Modeling and solving of transportation and assignment problems. Definitions and examples of network models. Project scheduling using CPM and PERT. Decision analysis. Modeling and solving inventory and queuing models. **Assessment:** Coursework 30%, Final Examination 70%	Assoc. Prof. Ahmad Shukri Yahya 04-599 6270 shukri@eng.usm.my Dr. Abu Ahmed Mokammel Haque 04-599 6288 cehaque@eng.usm.my
EAP 215 Water Supply & Water Treatment Engineering	3	II	Water source and usage; water source assessment; method on estimating water usage; water characteristics, quality, tests and standard; physical, chemical, and biological process in water treatment; treatment units design, water quality problems and water distributions solutions **Assessment:** Coursework 40%, Final Examination 60%	Assoc. Prof. Ir. Mohd. Nordin Adlan 04-599 6252 cenordin@eng.usm.my Assoc. Prof. Ir. Md. Azlin Md. Said 04-599 6202 azlin@eng.usm.my

EAH 225 Hydraulics	3	II	Flow in pipe, Rigid Boundary Flow, Loose Boundary Flow, Dimensional Analysis & Similitude Model, Pump & Turbine **Assessment :** Coursework 30%, Final Examination 70%	Assoc. Prof. Ismail Abustan 04-599 6251 ceismail@eng.usm.my Mr Zorkeflee Abu Hasan 04-599 5875 redac04@eng.usm.my
EAG 245 Soil Mechanics	3	II	Formation and Types of Soil, Phase Relationship, Clay Mineralogy, Soil Classification and Index Properties, Soil in Water; Permeability and Seepage, Stresses in Soil, Compaction, Consolidation and Settlement **Assessment:** Coursework 40%, Final Examination 60%	Assoc. Prof. Fauziah Ahmad 04-599 6268 cefahmad@eng.usm.my Mr. Muhd. Harris Ramli 04-599 6217 cemhr@eng.usm.my Dr. Molla Mohamad Ali 04-599 6289 cemmali@eng.usm.my
EAS 254 Structural Analysis	3	II	This course concentrates on the analysis of statically indeterminate structures. The course content includes; Concept of statical determinacy; Energy method for deflection in beams and frames; Force method for the analysis of statically indeterminate trusses, beams and frames; Displacement method for the analysis of statically indeterminate beams and frames; Plastic analysis and Influence Lines of Statically Indeterminate Beams. **Assessment:** Coursework 30%, Final Examination 70%	Dr. Lau Tze Lian 04-599 6252 cenordin@eng.usm.my Assoc. Prof. Taksiah A. Majid 04-599 6282 taksiah@eng.usm.my Assoc. Prof. Choong Kok Keong 04-599 6225 cekkc@eng.usm.my
EAA 273 Civil Engineering Practice	2	II	Introduction to Engineering Drawing, Layout Plan, Preliminaries work, Taking off, Estimation, planning and cost control, Geotechnical Consideration, Concreting, Drainage work, Road and pavement, Management and construction performance, Safety in construction, Environmental Considerations, Intensive Geomatic Practical. **Assessment:** Coursework 30%, Final Examination 70%	Dr. Farid Ezanee Mohamad Ghazali 04-599 6222 cefarid@eng.usm.my

EAA 304 Geotechnical, Highway & Traffic Engineering Laboratory	2	II	Introduction to laboratory practices and experiments. To familiarize the use of various testing equipment and enable them to conduct laboratory tests via hands-on **Assessment:** Coursework 100%	Prof. Meor Othman Hamzah 04-599 6210 cemeor@eng.usm.my Dr. Leong Lee Vien 04-599 6286 celeong@eng.usm.my Dr. Molla Mohamad Ali 04-599 6289 cemmali@eng.usm.my
EAH 325 Engineering Hydrology	3	II	Hydrology and it's important; World water balance; History of hydrology; Application in Engineering; Hydrological Cycle and Catchment Processes; Rainfall Measurement; Infiltration Measurement; Evaporation Measurement; Stream flow Measurement; Stream flow Hydrograph and Base flow; Statistical Hydrology and Frequency Analysis; Urban Hydrology; Ground Water. **Assessment:** Coursework 30%, Final Examination 70%	Assoc. Prof. Rozi Abdullah 04-599 6281 cerozi@eng.usm.my Dr. Syafalni 04-599 6291 cesyafalni@eng. usm.my Dr. Lai Sai Hin 04-599 5874 redaclai@eng.usm.my
EAL 335 Highway and Transportation Engineering	4	II	Transportation system entity; Traffic characteristics; Capacity of transportation and traffic facilities; Transportation planning and modeling; Aspect of Traffic safety; Public Transport; Traffic Management. **Assessment:** Coursework 30%, Final Examination 70%	Dr. Leong Lee Vien 04-599 6286 celeong@eng.usm.my Dr. Joewono Prasetijo 04-599 6290 cejoewono@eng. usm.my
EAG 346 Geotechnical Design	2	II	Geotechnical engineering design and analysis covering site investigation works, retaining wall, slope stability (application of GEOSLOPE software for design and analysis), and foundation (Shallow or Deep) **Assessment:** Coursework 100%	Assoc. Prof. Fauziah Ahmad 04-599 6268 cefahmad@eng. usm.my Mr. Muhd. Harris Ramli 04-599 6217 cemhr@eng.usm.my Dr. Molla Mohamad Ali 04-599 6289 cemmali@eng.usm.my

EAS 354 Timber and Steel Structural Design	3	II	This course is divided into two parts i.e. steel and timber designs. The first part covers the introduction of design for steel, design considerations, design of flexural member, compression member, tension member and connections. Roof trusses, plate girder and portal frames. The second part covers the introduction of design for timber using the local material. The students will be exposed to design of flexural member, axially and laterally loaded member (i.e. tension, compression and bending), roof trusses and connections. MS 544 Pt. 1 and 2 2001 will be used as a code of practice in their design calculation. **Assessment:** Coursework 50%, Final Examination 50%	Assoc. Prof. Badorul Hisham Abu Bakar 04-599 6203 cebad@eng.usm.my Dr. Fatimah De'nan 04-599 6271 cefatimah@eng. usm.my
EAS 355 Advanced Concrete Technology	2	II	Introduction to laboratory practices and experiments. To familiarize the the use of various testing equipment and enable them to conduct laboratory tests via hands-on. **Assessment:** Coursework 40%, Final Examination 60%	Dr. Shahid Kabir 04-599 6258 ceshahidkabir@eng. usm.my Assoc. Prof. Megat Azmi Megat Johari 04-599 6208 cemamj@eng.usm.my Dr. J. Jayaprakash 04-599 5517 jaypee@eng.usm.my
EAA 393 Computational Problem Solving in Civil Engineering	2	II	Background of software and purpose for civil engineering; Type of software, definition and method software, solving problem for civil engineering for example, commercial software in academic, research and operational/application for civil engineering. Methodology of software construction: Choosing appropriate problem, forming problem statement, programming language, design and development of software. Software application and appropriate for civil engineering: Validation process, bench mark process, software application, effective presentation **Assessment:** Coursework 100%	Dr. Lau Tze Liang 04-599 6284 celau@eng.usm.my Assoc. Prof. Ahmad Shukri Yahya 04-599 6270 shukri@eng.usm.my Dr. Shahid Kabir 04-599 6258 ceshahidkabir@eng. usm.my
EAP 412 Environmental Studies	4	II	Air Pollution – Definition and sources; classification and characteristics of pollution; impact of pollution; measurements; pollutant dispersion models, meteorological aspect on air dispersion; air pollution control Noise Pollution – Introduction; important characteristics of sound, sources, effect and regulation of noise pollution, measurement and analyses of noise, noise control Industrial waste management – Terminology and legislation aspect; waste handling-storage, collection, safety aspect; industrial wastewater; Industrial solid waste; waste reduction and cleaner production; treatment and disposal of non-hazardous industrial waste; treatment and disposal of hazardous industrial waste; clinical waste management **Assessment:** Coursework 40%, Final Examination 60%	Prof. Hamidi Abdul Aziz 04-599 6200 cehamidi@eng. usm.my Assoc. Prof. Nor Azam Ramli 04-599 6227 ceazam@eng.usm. my Dr. Mohd Suffian Yusoff 04-599 6223 suffian@eng.usm.my

EAL 432 Advanced Highway & Transportation Engineering	4	II	Transportation planning process, defining the study area, application of advanced travel demand models, furnishing the supply side of transport. Driver, vehicle and traffic characteristics, introductory design elements, sight distance, horizontal and vertical alignment, highway aesthetics, road cross section, at-grade and grade separated intersection, road geometrics and safety. **Assessment:** Coursework 40%, Final Examination 60%	Prof. Meor Othman Hamzah 04-599 6210 cemeor@eng.usm.my Dr. Leong Lee Vien 04-599 6286 celeong@eng.usm.my Dr. Joewono Prasetijo 04-599 6290 cejoewono@eng.usm.my
EAS 453 Pre-Stressed Concrete Design	2	II	Principle of pre-stressing, behavior of material, loss and pre-stressed, section analysis, deflection, shear, pre-stressed system and anchorage bond, design of pre-stressed beam. **Assessment:** Coursework 40%, Final Examination 60%	Assoc. Prof. Ir. Md. Azlin Md. Said 04-599 6202 azlin@eng.usm.my Dr. Norazura Muhammad Bonnuri 04-599 6259 cenorazura@eng.usm.my
EAS 454 Advanced Structural Engineering	4	II	Matrix method; Finite element method; Structural dynamics; Analysis of tall buildings; Wind load on structures based on Malaysian Standard; Introduction to Seismic Loading **Assessment:** Coursework 40%, Final Examination 60%	Assoc. Prof. Taksiah A. Majid 04-599 6282 taksiah@eng.usm.my Dr. Norazura Muhammad Bonnuri 04-599 6259 cenorazura@eng.usm.my Dr. Lau Tze Liang 04-599 6284 celau@eng.usm.my Assoc. Prof. Choong Kok Keong 04-599 6225 cekkc@eng.usm.my

| EAK 462 Geomatik Engineering Addition | 4 | II | Introduction: Introduction to advanced geomatic measurements concepts and contemporary practice of geomatic engineering. Modern survey; Field-to-finish (F2F) survey concepts; concepts of traditional and modern survey, total station system, cost benefit analysis, engineering surveying software. Distance measurement using EDM: introduction and principles of distance measurement, types of electromagnetic waves and signal, types of instrument and its usage in engineering, EDM test and data analysis. Building surveys: Building surveys; setting out buildings and large structures, methods of horizontal and vertical controls, setting out drainage and transfer of levels. Global Positioning Systems (GPS): principles of GPS, instrumentation design, positioning methods, errors and positioning accuracy, differential and real time positioning. Offshore positioning: instruments and depth measurement techniques, tides, datum levels and navigation chart.

Assessment:
Coursework 40%,
Final Examination 60% | Assoc. Prof. Wan Muhd. Aminuddin Wan Hussin
04-599 6211
cewan@eng.usm.my

Assoc. Prof. Mohd. Sanusi S. Ahamad
04-599 6224
cesanusi@eng.usm.my |
| EAA 492 Final Year Project | 6 | I & II | An individual project is required, which may involve research and development work, engineering design, literature survey, experimental work, theoretical work, computational studies, simulation, and implementation. Students will be assigned an individual research and development project, and a typed and bound thesis on the project should be submitted at a date to be determined by the Faculty

Assessment :
Coursework 100% | Assoc. Prof. Taksiah A. Majid
04-599 6282
taksiah@eng.usm.my |

Course Code/ Title	Unit	Semester Offered	Synopsis	Details of Lecturer
EEE 105 Circuit Theory	3	I	**Circuit Variables and Elements** Review of circuit analysis, International System of Units (SI), voltage and current, power, energy, basic circuit elements (passive and active), voltage and current sources, Ohm's law, Kirchhoff's laws, circuit models, circuits with dependent sources. **Resistive Circuits** Resistors in series and parallel, voltage and current divider circuits, measuring voltage and current, the Wheatstone bridge, Delta-to-wye (D-Y) equivalent circuits. **Techniques of Circuit Analysis** Introduction to node-voltage method, node-voltage method with dependent sources and special cases, introduction to mesh current, mesh current method with dependent sources and special cases, source transformations, Thevenin and Norton equivalent circuits, maximum power transfer, superposition. **Inductors and Capacitors** Inductor, voltage and current relationships, power and energy. Capacitor, voltage and current relationships, power and energy. Series and parallel combinations of inductance and capacitence. **Response of First-Order RL and RC Circuits** Natural response of RL anf RC circuits, step (forcing) response of RL and RC circuits, a general solution for natural and step responses, sequential switching, introduction to nutural and step responses of RLC circuits. **Sinusoidal Steady-State Analysis** Sinusoidal source, sinusoidal response, concept of phasor and phasor diagram, passive circuit elements in frequency domain (V-I relations for R, L and C), impedance and reactance, Kirchhoff's laws in frequency domain, circuit analysis techniques in frequency domains. **Sinusoidal Steady-State Power Calculations** Instantaneous power, average (active) and reactive power, the rms valve and power calculations, complex power and power triangle, impedance and maximum power transfer. **Power System Circuits** Single-phase and three-phase (Y and D) systems, balanced three-phase voltage sources, analysis of Y-Y and Y-D circuits, power calculations in balanced three-phase circuits, measuring average power in three-phase circuits. **Assessment:** Coursework 30%, Final Examination 70%	Assoc. Prof. Nor Ashidi Mat Isa 04-599 6018

| EEE 123 Computer Programming For Engineers | 3 | I | Introduction to C++ and Problem Solving
Computer organization, computer languages, basic software design. Introduction to C++ programming.

Declaring Types, Operators and Control Flow.
Declaring variable types - character, integer, floating point numbers, constants, headers. Operator types (communicative, logical, assignment, arithmetical, decrement, increment). Branching, conditional branching using if…else, case, switch, repetitive loops using while, do…while, for.

Functions and Program Structure
Use of functions in flow control, arguments, parameters, call by reference, call by value, files and recursion.

Storage Classes
Auto, extern, static, register and internal block.

Arrays
Array indices, cells, character strings, multi-dimensional arrays.

File Input/Output
High-level input/output using files and format.

Pointers
Pointer variables, pointer levels and arrays, pointer reference function calls.

Structure and Unions
Structures and operations on structures, pointers to structures, structure in a structure, unions.

Numerical Methods
Roots of equations, matrices, simultaneous equations, interpolations, integration and numerical differentiation.

Practical and hands-on lessons
Computer laboratory

Assessment:
Coursework 100% | Assoc. Prof. Junita Mohamad Salleh
04-599 6003 |
| EEL 102 Engineering Practice | 2 | I | This course is an introduction to basic mechanical machines and processes, electronic components, devices and instruments, electrical wiring, power supply circuit, design software package such as ORCAD and basic PCB. This course will not only introduce the students to the hardware side of electronics but will also expose them to computer tools that can assist them in the learning process by providing a visual representation of a circuit's behaviour and validating a calculated solution. This computational support is often invaluable in the electronic design process.

Assessment:
Coursework 100% | Dr. Asrulnizam Abd. Manaf |

| EEU 101
Computer
Pragramaming | 2 | I | Introduction to C++ and Problem Solving
Computer organization, computer languages, basic software design. Introduction to C++ programming.

Declaring Types, Operator and Control Flow.
Declaring variable types - character, integer, floating point numbers. Operator types (communicative, logical, assignment, arithmetical, decrement, increment).

Functions and Program Structure
Use of functions in flow control, arguments, parameters, call by reference, call by value, files and recursion.

Storage Classes
Auto, extern, static, register and internal block.

Arrays
Array indices, cells, character strings, multi-dimensional arrays.

File Input/Output
High-level input/output using files and format.

Pointers
Pointer variables, pointer levels and arrays, pointer reference function calls.

Structure and Unions
Structures and operations on structures, pointers to structures, structure in a structure, unions.

Practical and Hands-on Lessons
Computer laboratory

Assessment :
Coursework 100% | Assoc. Prof. Junita Mohamad Saleh
04-599 6027 |
| EEU 104
Electrical
Technology | 3 | I | Units, Definitions, Experimental Laws and Simple Circuits
System of units, charge, current, voltage and power types of circuits and elements. Ohms law, Kirchhoff's laws, analysis of a single-loop current, single node-pair circuit, resistance and source combination, voltage and current division.

Circuit Analysis Techniques
Nodal and mesh analyses, linearity and Superposition, source transformations, Thevenin's and Norton's theorems.

Inductance and Capacitance
The v-i relations for inductor and capacitor, inductor and capacitor combinations, duality, linearity and its consequences.

Source-free Transient Response of R-L and R-C Circuits
Simple R-L and R-C circuits, exponential response of source free R-L, R-C circuits.

Response to Unit Step Forcing Function
Response of R-L, and R-C ciruits to unit step forcing functions.

Response to Sinusoidal Forcing Function.
Charactiristics of sinusoidal forcing functions, response of R-L and R-C circuits to sinusoidal forcing functions.

Phasor Concept
The complex forcing function, the phasor, phasor relation ships for for R, L, and C, Impedance and admittance.

Average Power and RMS Values
Instantaneous power, average power, effective values of current and voltage, apparent power and power factor, complex power.

Power System Circuits
An overview of single and three phase systems, wye and delta configurations of three circuits, wye and delta transformations, and power calculations in three phase systems.

Magnetic Circuits and Devices
Concept and laws of magnetism and analysis of transformers. Introduction to electromechanical energy conversion, operation of machines as generators and motors, power loss, efficiency and operations at maximum efficiency.

Assessment:
Coursework 30%,
Final Examination 70% | Dr. Mohd. Fadzli Mohd. Salleh
04-599 6058 |

Course	Units	Sem	Description	Lecturer
EUM 111 Engineering Mathematics	4	I	Introduction to ordinary differential equations, Laplace transforms, partial differential equations, fourier series and calculus vectors. Some aplications in engineering field. **Assessment:** Coursework 30%, Final Examination 70%	Dr. Norizah Mohammad 04-599 6054
EUM 112 Numerical Methods and Engineering Statistics	4	II	Introduction to matrix algebra, numerical methods, complex numbers and applied probability and statistics. Some aplications in engineering field. **Assessment:** Coursework 30%, Final Examination 70%	Dr. Norizah Mohammad 04-599 6054
EEE 125 Basic Circuit Laboratory	3	II	This course comprises of 10 experiments that will be conducted by the students. The experiments are on multimeter application, the measurement of voltage, current and resistance in a dc circuit ,oscilloscope and function generator,capacitor, inductor and power measurement in ac circuits, superposition, Thevenin and Norton theorems, series resonance, parallel resonance, design of low voltage power supply, BJT and FET characteristics, design of combinational logic circuits **Assessment :** Coursework 100%	Dr. Asrulnizam Abd. Manaf
EEE 130 Digital Electronic I	3	II	Introduction Logical and digital electronics systems design. Numbering Systems Numbering systems, numbers represention, arithmetics operation and code systems. Switching Algebra and Standard Boolean Functions Logical Algebra, digital logic functions, symbols and logic algebra theorem. Method of Minimizing Boolean Functions Algebraic Boolean functions and K-map method. Combination Circuits Design Arithmetic logic circuits, control circuits, certain logical project and real world and timing phase. Bistable Memeory Devices Bistable memory circuits model of a combined circuits, basic sequential circuits, timing phase characteristics. Synchronous Sequential Circuits Moore model for synchronous-state machines, Mealy and combined state figure, state table, equivalent state, state assignment, acomplementary specific figure, ideal complimentary specific figure, analisis litar segerak, real world synchronous circuits complimentary design, synchronous counter and synchronous shift register. Asynchronuos Sequential Circuits Premitive flow Table, Implication chart, Combination Figure, Timing figure, cylics, running and free running. Implmentation of logic using SSI, MSI and Programmable devices. **Assessment:** Coursework 30%, Final Examination 70%	Dr. Rosmiwati Mohd Mokhtar

| EEE 132 Electronic Devices | 3 | II | Semiconductor Material and P-N Junction
Conduction in semiconductor (current carriers, mobility, drift velocity, mean free path, lifetime of charge carriers, conductivity, resistivity, charge density, current density, drift and diffusion currents), Silicon and Germanium semiconductors, intrinsic and extrinsic semiconductors, Fermi-Dirac function and Fermi level, Hall Effect, p-n junction and current components in p-n junction, p-n junction biasing and current-voltage characteristic.

Diode and its Applications
Piecewise linear diode model, rectifying diodes, half-wave and full-wave rectifiers, rectifier-filter circuit, clipping and clamping diode circuits, special purpose diodes: zener diode, LED, tunnel diode, photo diode, laser diode, varactor diode, Schottky diode.

Bipolar Junction Transistor (BJT)
Transistor structure, transistor basic operation, transistor parameters and rating, transistor as an amplifier, transistor as a switch, transistor configurations (CB, CE, CC), BJT input and output characteristics.

BJT biasing
Load line, Q point/dc biasing point, base/fixed current biasing, collector feedback/collector-base biasing, voltage-divider biasing. BJT low frequency small signal models: hybrid- model and r-parameter model/T model.

Field Effect Transistor (FET) and Biasing
Junction Field Effect Transistor (JFET): JFET basic operation, JFET characteristics and parameters, JFET biasing: fixed biasing, self biasing, midpoint biasing, voltage-divider biasing. MOSFET (DE MOSFET and E MOSFET) operations, MOSFET characteristics and parameters, MOSFET biasing: zero biasing, drain feedback biasing, voltage-divider biasing.

Assessment:
Coursework 30%,
Final Examination 70% | Dr. Norlaili Mohd Noh
04-599 6023 |
| EEE 208 Circuit Theory II | 3 | I | Mutual Inductance
A Review of Self-Inductance, the concept of mutual inductance, the polarity of mutually induced voltages (the dot convention), energy calculations, the linear and ideal transformer, equivalent circuits for magnetically coupled coils, ideal transformers equivalent circuits

Introduction to the Laplace Transform
Definition of the Laplace transform, the step function, the impulse function, functional transforms, inverse transform, poles and zeros of F(s), initial and final value theorem

The Laplace Transform in Circuit Analysis
Circuit elements in the S domain, circuit analysis in the S domain, the transfer function, the transfer function in partial fraction expansions, the transfer function and the convolution integral, the transfer function and the steady-state sinusoidal response, the impulse function in circuit analysis

Frequency Response for AC Circuits
Frequency response (magnitude plot and phase, pass-band, stop-band), cut-off frequency, typical filter, RL and RC low-pass filter, RL and RC high pass-filter, band-pass filter RLC (resonance frequency, bandwidth, Q factor), stop-band filter RLC (resonance frequency, bandwidth, Q factor), frequency response using Bode diagram (complex poles and zeros)

Fourier Series
Overview of Fourier Series, the Fourier Coefficients, the effect of symmetry on the Fourier Coefficients, an alternative trigonometric form of the Fourier series, Fourier series analysis for first order circuits (RL and RC), average power calculations with periodic functions, the rms value of a periodic function, the exponential form of the Fourier series, amplitude and phase spectra

The Fourier Transform
Derivation of the Fourier Transform, the convergence of the Fourier integral, relationship between Laplace and Fourier transform, Fourier transform in the limit, properties of Fourier transform, circuits analysis using Fourier transform, Parseval theorem and energy calculation involving spectrum magnitude

Two-Port Circuits
The terminal equations, the two-port parameters (Z, Y, A, B, H, G), relationship amongst two-port parameters, analysis of the two-port circuits with load (such as Zin, I2, VTh, ZTh, I2/I1, V2/V1 and V2/Vg), relationship among two-port circuits (cascade, series, parallel, series-parallel, parallel-series)

Assessment:
Coursework 30%,
Final Examination 70% | Dr. Haidi Ibrahim
04-599 6606 |

EEM 221 Principles and Mechanics of Materials	3	I	Principles of Materials: Introduction to metallic materials and their alloys, polymers, ceramic and composite structures. Phase diagram. Heat treatment. Plastic and linear behaviour of polimers, elastomer, semiconductor and magnetic material. Electrical behaviour of materials. Metalurgical Failure and non-destructive testing. Mechanics of Materials: Concept of Stress and Strain. Torsion. Pure Bending. Stresses and Deformations in Elastic Range. Plastic Deformation. Mohr's Circle for Plane Stress. Energy Method. Optical Technique in Stress and Strain Analysis. Introduction to Finite Element Analysis (FEA). **Assessment:** Coursework 40%, Final Examination 60%	Dr. Anwar Hasni Abu Hassan 04-599 6031 Assoc. Prof. Mahfoozur Rehman 04-599 6068
EUM 222 Probability and Applied Statistics	4	I	To emphasize on theoretical concepts and probability distribution for radom two variables distribution. To introduce applied statistical methods apply in analyzing experiments' results. Examples of applications in engineering will be given in the course. **Assessment:** Coursework 30%, Final Examination 70%	Assoc. Prof. Ahmad Shukri Yahaya 04-599 6034
EEM 223 Thermofluids	3	I	Basic concepts of thermodynamics and fluid mechanics, Laws of Thermodynamics, Properties of pure substances; Energy transfer; Static fluids; Bernoulli and Energy Equation for steady flow; Pipe flow; Continuity Equation; Momentum equation. **Assessment:** Coursework 40%, Final Examination 60%	Assoc. Prof. Mohd. Zulkifli Abdullah
EEE 231 Digital Electronics Laboratory	3	I	Logic gate IC, NAND TTL gates, Combination Logics, Flip-Flop, Synchoronous counters and ripples, Shift Registers, Counter Systems, Schmitt triggers and their applications, Multivibrators and Timer 555, Comparators and Multiplexers, "Programmable Logic", Applications of PAL and PLD. **Assessment:** Coursework 100%	Mr. Arjuna Marzuki 04-599 6021
EEE 241 Analog Electronics I	3	I	Small-signal Transistor Amplifiers Small-signal operation, ac equivalent circuit, common-emitter, common-collector and common-base configurations, approximate hybrid equivalent circuit, exact hybrid equivalent circuit. FET Small-signal Amplifiers Small-signal FET model, fixed-bias FET, self-bias FET, voltage-divider bias, common-source, common-drain and common-gate configurations. Multi-stage Amplifiers Cascade, cascode, Darlington pairs and transformer-coupled amplifiers. Operational Amplifiers Basic op-amp operation Large-signal Amplifier Operation and circuits of class A, class B, class C and class D amplifiers, push-pull amplifiers. Amplifier distortion, power transistor and heat-sink. Frequency Response Basic concepts, Miller's theorem, decibel, low-frequency response, high-frequency response, complete frequency response, frequency response of FET amplifier, frequency response measurement Circuit Simulation using PSPICE **Assessment:** Coursework 30%, Final Examination 70%	Dr. Norlaili Mohd. Noh 04-599 6023 Mr. Zulfiqar Ali Abd. Aziz 04-599 6065

EEM 241 Mechatronic Laboratory I	3	I	Three sets of experiments will be conducted: Experiments on Digital Electronics IC Gate logic, Flip-flop, Synchronous and asynchronous counter, Shift register, Timer device, Schmitt trigger and its applications, Multistable and 555 Timer, Comparator and multiplexer, Programmable logic and examples of PAL and PLD usage . Experiments on Analog Electronics Diode and applications, BJT and FET. Multi-stage amplifier, Power amplifier, Frequency response and mini-project. Experiments on Principle and Mechanics of Material Identification of engineering materials and its characteristics, atomic arrangement, porosity and density of material, and fluid viscosity. **Assessment:** Coursework 100%	⊕ Dr. Khoo Bee Ee ✆ 04-599 6032
EEE 226 Microprocessor I	3	II	Introduction Fundamental microprocessor system, types of microprocessor, I/O subsystem, memory subsystem, programming. Internal Microprocessor Architecture CPU structure, data bus, address and control, register, I/O, interrupt, stack, special functions, I/O and memory addressing, instruction set and address mode, timing, instruction implementation. Microprocessor Programming Assembly language, assembly process, programming format, instruction sets, data transfer, arithmetic, branching, bit manipulation. Arithmetic operation, fixed point(sign and unsigned), floating point, BCD. I/O Operation Controlled programming I/O, interrupt, priority interrupt, Digital data input and monitoring. Data input using switch, keypad. Input and Output Data Analog Analog to digital signal conversion and vice versa, sampling theory, sample and hold, signal adaption, analog to digital converter, digital to analog converter. Fundamental of Microprocessor System. Memory and I/O address decoding, I/O interfacing, memory interfacing: RAM and ROM, basic software system, Designing the basic system. Laboratory Microprocessor laboratory covers all the above topics. **Assessment :** Coursework 100%	⊕ Dr. Syed Sahal Nazli Alhady ✆ 04-599 6061

EEE 230 Digital Electronics II	3	II	Introduction to Digital System Representations Gates, Layout, FSM, HDL Combinational System and VHDL Combinational System Specification, Combinational Integrated Circuit: Characteristics and Capabilities, Representation and Analysis of Gate Networks, Combinational System Design: Two-Layers and Multi-Layers Sequential Systems and VHDL Sequential System Specifications, Sequential Networks Combinational and Sequential Modules Standard Combinational Modules, Combinational Arithmetic Modules and Networks, Standard Sequential Modules, Programmable Modules Memory and Programmable Logic Devices (PLDs) Definition of Memory, PLD and RAM, RAM Configuration, PAL/PLA, FPGA/CPLD Transfer Register and Databus Databus and Its Operation, Transfer Register Operations, Micro-Operations, Types of Transfers: Multiplexes, Bus, ALU, Shifter, Pipeline Databus Sequencing and Control Control Unit, ASM, Hardwired and Microprogramming Control, Simple Computer Architecture, Single Cycle and Multi-Cycles Computer Organisation Order Set Architecture, CPU Design, I/O Communication, Memory System, Specification and Implementation of Microcomputers Project Project uses FPGA devices such as Xilinx, Altera, which involves from schematic design to programming. **Assessment :** Coursework 40%, Final Examination 60%	Assoc. Prof. Nor Ashidi Mat Isa 04-599 6051 Mr. Ahmad Nazri Ali 04-599 6020
EEE 243 Analog Electronics Labratory	3	II	Diode and applications, BJT and biasing, FET and biasing, Mulistage Amplifier, Power Amplifier, Filters , frequency response and Mini Project. **Assessment:** Coursework 100%	Mr. Zulfiqar Ali Abdul Aziz 04-599 6065
EEE 270 Analog Electronics II	3	II	Operational Amplifier (Op-Amp): Op-Amp operation, differential amplifier and common mode, op-amp parameters, basic op-amp circuits, practical op-amp, op-amp data sheet. Op-Amp Circuits Applications and Frequency Response Multiplier, summer, buffer, comparator, integrator, differentiator circuits, and frequency response and compensator. Feedback Circuits Feedback concept, types of feedback connection, practical feedback circuits, feedback amplifier. Oscillator Circuits Basic operations, Phase shift, Wien bridge, Crystal oscillator, Unijunction device. Active Filters Basic filter, Filter response characteristics, Low-pass filter, High-pass filter, Notch-pass filter, Band-pass filter, Measurement of filter response, Filter design: Butterworth, Chebychev and Elliptic. Voltage Regulator, Voltage regulation, Serial regulator, Shunt regulator, Switch regulator, IC Voltage regulator, Regulator applications. **Assessment:** Coursework 30%, Final Examination 70%	Assoc. Prof. Tun Zainal Azni Zulkifli 04-599 6010

| EEK 241 Electrical Power Technology | 3 | II | Review The Physic of Electricity:
Basic quantities, voltage, current, conductivity, resistance, conductance, impedance, insulation. Electric circuit fundamentals, static charge, electric circuit, voltage drop, electric shock, transmission voltage and resistive losses, electric and magnetic fields, electromagnetic induction and application of Kirchhoff's law for voltage and current

Electrical network: Ac and DC network, Current and voltage characteristics, The average, effective or rms values. Phasor and graphics. The real, reactive and complex power. Phase angle and power factor correction. Single and three-phase systems. Per-Phase Analysis and single line diagram.

Electric Power Generating: The principle operation of generator, type of electric power plants, alternative power plants, synchronous Generator and basic components and functioning. Real and reactive power of generator. Single line model of AC generator. Loading of generator.

Electric Utility Power System: Transmission of electrical energy, principal components of power transmission system, type of power transmission, standard voltage, component of transmission line, fundamental objectives of a transmission line, equivalent circuit of lines. Direct-current transmission, Substation of power distribution system, substation equipment, type of power distribution system, circuit breaker, disconnecting switches, grounding, arrester, voltage regulation and low-voltage distribution.

Loads: Type of loads on power system, resistive loads, inductive loads and motors, electronics equipment loads. Load profiles and loads duration curve. Simple Load flow calculation, power factor and power factor correction.

Power Instrumentation: Type of electrical instrumentation, moving coil, hot wire, thermocouple, electrodynamics, pointer, AD and DC instrumentation, Ammeter, Voltmeter, Wattmeter, VAR meter, frequency meter. Classification and standard of Instrumentation, Measurement methods for current, voltage, power and power factor in single phase and three-phase. Magnetic measurement, Digital instrumentation.

Laboratory: Experiments will be conducted encompassing basic electric system (Generator, transformer, transmission, loads, real power, reactive power, complex power, electrical measurement and instrumentation)

Assessment:
Coursework 40%,
Final Examination 60% | Assoc. Prof. Soib Taib
04-599 6012

Dr. Dahaman Ishak
04-599 5810 |
| EEK 260 Electrical Machines | 3 | II | Fundamentals of Magnetic Circuits:
Magnetic field in conducting coils; important magnetic parameters (Á, H, Â, f, B, m); effect of hysteresis; magnetic core loss; equivalent magnetic Circuits in series and parallel.

Transformers
Type, construction, characteristics, and operating principle; V I relations and power calculations; ideal transformer; modeling of transformer; equivalent circuit; determination of model parameters (open circuit and short circuit tests); loading of transformer; voltage regulation; efficiency; auto transformers; instrument transformers (CT and VT); three-phase transformers.

DC Generators
Operating principle; construction; commutator action; armature windings; e.m.f. Equation; self and separately excitation; shunt, series and compound generators; voltage regulation; losses and efficiency.

DC Motors
Operating principle; torque equation; characteristics of shunt, series and compound motors; Starting, speed control, and industrial applications of DC motors.

Three Phase Machines
An introduction to three-phase synchronous and induction machines; construction and principle of operation.

Assessment:
Coursework 30%,
Final Examination 70% | Dr. Dahaman Ishak
04-599 5810

Dr. Mohamad Kamarol Mohd. Jamil
04-599 6064 |

EEM 232 Mechatronic Systems	4	II	**Mechatronics System and General Instrumentation** Elements of measurements systems, static and dynamic analysis, steady state measurement, system analogy. **Signal and Noise in Mechatronics Systems** Analysis of signal and system, signal representation and modeling, Thevenin and Norton noise equivalents, intrinsic and extrinsic noise, electromagnetic coupling, common mode voltage, noise suppression techniques, **Transducers and Sensors** Transducer classification, basic transducer for measuring electrical quantities, basic transducers for measuring non-electrical quantities, electrical and mechanical actuators, optical transducers, display technology. **Signal Condition Elements** Sampling theory, A/D and D/A converters, analog and digital signal processing, real time interfacing **Mechanical Design** Strength of mechanical elements, design of mechanical components, flexible elements and mechanical modeling. **Assessment:** Coursework 30%, Final Examination 70%	Dr. Anwar Hasni Abu Hassan 04-599 6031
EEM 253 Mechatronic Design I	2	II	**Theory:** Fundamental mechatronics design theories and experimental implementations. **Practical:** Experiments of application of actuators and drives, computer simulation of mechatronic systems, and computer-aided mechatronics design. **Assessment:** Coursework 50%, Final Examination 50%	Dr. Khoo Bee Ee 04-599 6032 Dr. Rosmiwati Mohd. Mokhtar 04-599 6056
EEE 320 Microprocessor II	3	I	**Structured System Design Procedure** To verify of requirements, systematic design and easy-test, system implementation, testing and debugging **Microcontrollers** Detailed architecture of typical 8, 16 and 32 bit microcontrollers, assembly language programming for the MSC-51 and MCS-96 family, I/O interfacing examples, design of embedded systems using microcontroller. **Embedded System Design** CPU requirements, microcontroller architecture and applications, embedded microprocessors concept, DSP and embedded PC. **High Reliability Design** EMI problems, ESD, grounding, noise, power supply, PCB design, compliance testing. **Microcontroller Interfacing to External Memory** Semiconductor memory, Memory Address Decoding, ROM interfacing, Data Memory Space. Laboratories 1. A Square Wave generator using external ports 2. Running Light using timer operation 3. Monitoring Status through the I/O bits 4. Basic Data Entry Methods- Keypad, DIP switch. 5. Interrupt Programming 6. Event counter programming. **Assessment:** Coursework 50%, Final Examination 50%	Dr. Zaini Abdul Halim 04-599 6061

| EEE 332 Communication | 4 | I | **Introduction to Information Transmission**
Analogue and digital systems modeling including information sources, transmitter, communication receiver channels and information sink. Information Sources characteristic such as audio, video, computer data, static materials, etc. and communication channels characteristic including noises, interferences and distortions.

Communication Channels Concept
Telephone lines or free space. Bandwidths' distribution and limitation in telephone lines or free space. Communication system modeling compared to existing communication systems such as telegraphy, telephony, radio, TV, facsimile, videotext dan komputer.

Modulation Techniques
Purpose of modulation, Linear modulations such as AM, DSBSC, SSBSC, VSB. Phase modulations such as FM and PM. Advantages of FM compared to AM. Generation and demodulation of AM and FM.

Noises in Communications
Noises and their effect on communication systems. Type of Noises: shot noise, thermal noise and white noise. Noise temperature and noises in linear networks: noise figure and noise measurement in dB.

Introduction to Data Transmissions
Advantages of digital communication systems. Sampling theorem, aliasing. Pulse code modulation: - and A- law. Multiplexing: TDM, FDM, PAM, PWM, PVM and cross-talk. Representation of various types of binary signals: unipolar, dipolar, AMI, RZ and NRZ; peak and average power, Spectrum details, Detection of baseband signals in Gaussian noise: bit error rate using ideal filters. Random pseudo-noise characteristic and applications.

Optimum Receiver
Optimum filter concepts. Matched filter and correlation detection. Filters for synchronous digital systems, intersymbol interference, Nyquist filter thoerems, applications of cosine type filter and phasor diagram. Introduction to decision–making theory.

Information Theory and Coding
History and background. Information, entropy and joint and conditional entropies. Channel capacity, discrete and continous channel, Shannon-Hartley theorem, bandwidth and S/N.

Assessment:
Coursework 30%,
Final Examination 70% | Dr. Norlaili Mohd. Noh
04-599 6023 |
| EEE 348 Introduction to Integrated Circuit Design | 3 | I | **Intoduction**
Microelectronics history, Design representativ, Abstraction levels of digital system desig: System, Function, Circuits, Layouts, Physical,Design level, CAD and IC design process, Logic technologies, ASIC and probrammable IC (FPGA) technologies

Principle of Layout Design
Bipolar design, MOS design, MOS devices modeling, NMOS circuits design, CMOS circuits design, Design training on ASIC

Memory Systems
ROM, addressing, SRAM, DRAM, cache memories.

VHDL
Digital system simulation, Basic concept of VHDL language, Characterization modeling, Structure modeling, Sequence processing, Type of Data, Sub-program, Package and Library, Basic Input/Output, Simulation and Synthesizing, Test bench in VHDL, VITAL application, CPU design and implementation of FPGA.

Assessment:
Coursework 40%,
Final Examination 60% | Assoc. Prof. Othman Sidek
04-599 6083 |

| EEE 350
Control Systems | 3 | I | Introduction and revision on basic mathematics.
An introduction to control systems, types and effects of feedback. Complex variables, difference and differential equations and Laplace transform.

Transfer Function, Block Diagrams and Signal-Flow Graphs.
Impulse response, transfer functions, block diagram, signal-flow graph and gain formula.

Mathematical Modelling for Physical Systems.
Electrical networks, mechanical systems, sensors and encoders, non-linear systems.

Linear System Stability.
Bounded-input bounded-output, zero-input stability, Routh-Hurwitz stability criterion.

Tile Response Analysis.
Time response, test signals, time-domain specifications, steady-state error, transient response of second-order systems, effects of zero-pole placements, higher-order system approximation.

Root Locus Techniques.
Root locus characteristics, building root locus and root contour.

Time-domain Analysis.
Peak amplitude and frequency, bandwidth, bode-plot polar and Nyquist plots, stability criteria, gain and phase margins.

Time-domain and Frequency-domain Controller Design.
Phase-lead controller, phase-lag controller, lead-lag controller, zero-pole cancellation, lead and feedforward compensation.

PID controller Design and Analysis.
Basic concept of PID controllers, PD controllers, PI controllers, PID controllers, Ziegler-Nichols tuning methods, PI-D and I-PD controllers, implementation and practical aspects.

Assessment :
Coursework 40%,
Final Examination 60% | Dr. Harsa Amylia Mat Sakim |
| EEE 376
Electromagnetic Theory | 3 | I | Vector Analysis (Review)
Vector and scalar quantities, Gradients, Curls, Laplacian, Divergiences and Stoke's law.

Electrostatic Fields
Basic Laws: Coulomb, Gauss, Electric flux density, Electric field intensity, and Electric potential. Laplace and Poisson equations, boundary's conditions, Electrostatics field in dielectric materials, Capacitance. Energy in electrostatic fields.

Magnetostatic Fields
Biot-Savart's law, Ampere's law, magnetic flux density, magnetic field intensity and magnetic pontential, boundary's conditions.

Theoretical and Application of Transmission Lines
Equivalent circuits, generalized equations for currents and voltages, waves and transients characteristic in transmission lines, power in transmission lines, impedance matching techniques using Smith Chart.

Assessment:
Coursework 30%,
Final Examination 70% | Assoc. Prof. Tun Zainal Azni Zulkifli

04-599 6010 |

EEK 361 Power Electronics	3	I	Introduction to Power Electronics Type of power electronic controls, efficiency of power electronics circuit, switching devices rating, switching semiconductor applications, analysis method. Power Diode PN diode, static model, diode recovery operation, Schottky diodes, dynamic performance, diode applications, power diode connections. Thyristor Turn on requirement, on state voltage, get current requirement basic turn off, thyristor voltage variation, thyristor operation, two transistor model of thyristor, TRIAC, GTO, LASCR Power Transistor BJT, on state model and cut off model, safe operating area, MOSFET modeling and capacitances, MOSFET switching losses, MOSFET turn on and turn off, MOSFET switching losses, MOSFET sources inductance, IGBT, FCT, MOS-Controlled. Design Considerations Semiconductor junction temperature, single pulse operation, periodic pulses operation, over current protection, over voltage protection, external transients, thermal protection. Power Electronics Circuits Uncontrolled rectifier, controlled rectifier, single and three phase ac to ac control, dc to dc converter (Buck, Boost and Buck-Boost). Applications of Power Electronics Circuits House – equipments, Industries and Electrical generations **Assessment:** Coursework 30%, Final Examination 70%	Dr. Ir. Syafruddin Masri 04-599 6018
EEM 321 Manufacturing Management and Technology	3	I	Processing Operations; Assembly Operations; Production Facilities; Manufacturing Support Facilities; Aggregate Planning and Master Production Schedule; Material and Capacity Requirements Planning; Managing Work-in-Progress; Measurement and Inspection Principles; Conventional Measuring Instruments and Gages; Group Technology; Surface Mount Technology, Microsystem Technology **Assessment:** Coursework 40%, Final Examination 60%	Assoc. Prof. Zalina Abd. Aziz 04-599 6034 Dr. Anwar Hasni 04-599 6031 Dr. Norizah Mohammad 04-599 6054
EEM 352 Mechatronics Design II	2	I	Process Design Aspects Components selection, suitability, Man-machine interfacing, Ergonomic, Asthetic, Safety in a typical mechatronics product design. Design Procedures Selection, Design and integration of mechatronics system elements such as sensors, microcontroller, machine vision system, actuator, mechanism and structure in the design of a complete mechatronics system practicing the project design philosophy. Mini Project This course also involves group-based mini-projects to nurture group-work efforts. **Assessment:** Coursework 40%, Final Examination 60%	Dr. Anwar Hasni Abu Hassan 04-599 6031

Course	Credit	Sem	Synopsis	Lecturer
EEE 322 RF & Microwave Engineering	4	II	**S-parameter** Circuit analysis using S-parameters **Microwave Devices and Passive Components** Transmission line: microstripline/stripline, terminators, attenuators, phase shifters, directional couplers, hybrid branch, power dividers, Faraday rotation, circulators, Isolators, SAW devices and resonators. **Filters** Design of filters using image parameter method, insertion loss method, filter transformation, microstripline filter, narrowband filter, lowpass filter, bandpass filter and bandstop filters **Microwave Sources and Mixer** Klystron, Magnetron, Travelling wave tubes, Gunn diode, IMPATT diode, TRAPPATT diode, mixer **Amplifier Design** Bipolar transistor, FET, biasing, stability, low noise amplifier **Oscillator Design** One port negative resistance oscillator, Transistor oscillator, dielectric resonator oscillator, noise in oscillator. **Assessment:** Coursework 50%, Final Examination 50%	Dr. Aftanasar Md. Shahar 04-599 6084
EEE 344 System VLSI	4	II	**Digital Circuit Techniques and Layout Design** MOS Transistor Equations, NMOS and CMOS Inverter Design, Voltage Transfer Curve (VTC), Transient Characteristic, Estimation of Rise Time and Fall Time, Noise Margin, Body Effect and Channel-Length Modulation, Operation of MOS Pass-Transistor, Leakage Current, Drift Velocity Saturation Effects, MOS Parasitic Effect, Parasitic Capacitance Estimation, RC Delay Effects for MOSFET Pull-Up and Pull-Down Chains, Pseudo-NMOS Inverter, MOSFET W/L Ratio Determination Techniques, CMOS Latch-Up Effect and Techniques to Avoid Latch-Up, Guard Rings, I-V Equations for Non-uniform FET Composite, FET Structures, Effects of Drain and Source Resistances, Layout Technique and Placement Design, Electromigration, Estimation of V_{DD} Rail-to-Rail and V_{SS} Rail-to-Rail, domino-CMOS Circuit Technique, NORA-CMOS Circuits, I/O Pad and Three-Phase Buffer Circuits, ESD Protection, Clock Distribution Techniques, Scaling Effects. **VLSI Logic Circuits** CMOS Circuit Techniques for Look-Ahead Carry, Bypass Carry Adder, Series and Systolic Multiplier Circuits, Two-Phase non-Overlapping Clock Generator, pseudo-NMOS and CMOS PLA Circuits, CMOS Pass Transistor Logics, Pre-charged Bus Circuits. **VLSI Architecture** Implementation of Signal Processing and Communication Algorithms, CMOS Circuit, Series Processing and Systolic Architecture Design, Critical Delay, System Phase, Floor Planning, Top-Down and Bottom Up Design Consideration, Block and Cell Placement Consideration. **VLSI Testing** Design and Testability, Self Test, Built-In Self Test, D Algorithm, Test Vector Generation, BIBLO and pseudo-random Tests, Sensitivity Design. **Projects** Implementation of Signal Processing and Communication Algorithms, CMOS Circuit **Assessment:** Coursework 50%, Final Examination 50%	Dr. Bakhtiar Affendi Rosdi 04-599 6083

Course				Description	Contact
EEE 351 Advanced Laboratory	3	II		**Control** Speed control system, PID controller. **Microelectronics** VHDL, FPGA [Design and simulation]. **Electronics** Filter design [passive/active] for Butterworth and Chebyshev, Aplication of Op-Amps circuits(5 – 6 circuits) **Communications** Amplitude modulation and detection [AM and FM], PLL. **Power Electronics** Buck and Boost-chopper, Controlled- Rectifier (1-f, 3-f) **Assessment :** Coursework 100%	Prof. Dr. Lim Chee Peng 04-599 6033
EEE 354 Digital Control Systems	3	II		**Introduction to Discrete-time Systems and Z-transform** Digital Control Systems, Control Problems, Discrete-time Systems, z-Transform Methods, Solution of Difference Equations, Simulation Diagram and Flow Graphs, Transfer Functions **Sampling and Reconstruction** Sampled-data Control Systems, Ideal Sampler, Data Reconstruction, characteristics of star transformation. **Open-loop System** Pulse Transfer Functions, Digital Filters, Modified z-Transform, System With Time Delay, asynchronous sampling, Discrete State Equation. **Closed-loop Systems** Basic concept, Transfer Function Derivation, Variable State Space Model. **Time-response** Time Response, Mapping of s-Plane to z-Plane, Steady-State Accuracy, Simulation. **Stability** Stability Concept, Bilinear Transformation, Routh-Hurwitz Criterion, Jury Stability Test, Root Locus, Nyquist Criterion, Bode Diagram, Frequency Response. **Digital Controller Design** Specifications, Compensation, Phase-Lag Controller, Phase-Lead Controller, Lag-Lead Controller, Integral and differential Controller, PID Controller Application of MATLAB and SIMULINK **Assessment:** Coursework 40%, Final Examination 60%	Dr. Harsa Amylia Mat Sakim 04-599 6033

EEE 355 Robotic & Automation	4	II	**Introduction** Robot classification, Robot component, Automation, Economical consideration, Robot application **System Overview** Basic components, Robotic system, Function of robotic system, Robot specification **Mechanical Systems** Dynamic component, Modeling, Transformation and Kinematic Mechanical concept, Motion Transformation, Actual components, Mechanical system modeling, Kinematic analysis, End effector, Resolution, Repeatibility, Accuracy, Force, Lagrangian, Matrix transformation, and Jacobian. **Actuator Control** Position servo closed loop control, Friction and effect of gravity, Frequency domain, Robot arm control, Stepper motor, DC motor, Actuator, Pneumatic system and servo driver **Sensory Device** Non-Optical position sensor, Optical position sensor, Incremental encoder, Velocity sensor, Accelerometer, Proximity sensor, Tactile and Touch sensor, Force and Torque sensors. **Computer Vision** Vision components, Image representation, Hardware balance, Image encoding, Object recognition and Classification. **Computer Control System** Robot programming, Trajectory planning and Computer system. **Automation System** Automated System Design, Integration, Monitoring and Sensor Fusion **Assessment:** Coursework 40%, Final Examination 60%	Dr. Khoo Be Ee 04-599 6032 Assoc. Prof. Mohd. Rizal Arshad 04-599 6002
EEE 377 Digital Communication	4	II	**Digital Modulation Techniques** ASK, FSK, PSK, signal spectra and bit error rate. Equivalent binary PSK and DSBSC ASK. Introduction to m-ary systems such as PSK-4 and 8-phase. Generation and detection of PSK and realization of CPSK and DPSK, M-ary QA, M-ary FSK, Spread –spectrum modulation technique. **Detection/Receiver** Signal detection in Gaussian Noise Matched filter receiver, correlation detection, coherent detection, incoherent detection. **Coding** Shannon-Hartly data compression theorem and the effects. Coding without noise , removing redundancy and construction of Huffman code. Shannon-Fana code. Error control coding, types of error and code, techniques of controlling error. Hamming code and Hamming distance, Cylic code, convolution code – method of coding and decoding. **Communication Data Control** Generation of random bit, data encription and decription. **Assessment:** Coursework 30%, Final Examination 70%	Dr. Mohd. Fadzli Mohd. salleh 04-599 6016
EEK 360 Electrical Laboratory	3	II	Laboratory experiments are on single phase and three phase rectifiers, 3 phase transformer, synchronous generator, transmission line voltage regulation, distribution system, characteristics and performance of the synchronous machine, DC machine, induction machine, machine drive using PWM technique and chopper circuit. **Assessment :** Coursework 100%	Dr. Ir Syafrudin Masri 04-599 6018

| EEK 366 Electrical Machines & Drives | 4 | II | **General Principles**
Electromagnetic theory, sign conventions in rotating machines, three-phase circuits, 4-coil / 2-axis machine, force and torque components.

DC Machines
EMF, voltage and torque equations, losses and efficiency, ideal characteristics for separately excited, series, shunt machines.

AC Machines
Introduction to voltage and torque equations, armature reaction, excitation and voltage regulation, synchronous machines (phasor diagram, characteristics, equivalent circuit, saliency, synchronous reluctance motors), induction machines (equivalent circuit, characteristics, speed control), linear motors.

DC Drive Systems
Control using DC choppers and phase angle controlled rectifiers, dynamic equations, computer simulation.

AC Drive Systems
Three-phase bridge inverter, variable speed inverter-fed induction and synchronous motor drives, computer simulation, concept of vector control.

Small Motor Drive Systems
Hybrid-stepping motors (characteristics and control), trapezoidal and sine wave brushless DC drives, switched reluctance drives, AC commutator motors (small).

Laboratory
Experiments on AC and DC drive systems with power electronic controllers.

Assessment:
Coursework 40%,
Final Examination 60% | Dr. Ir. Syafrudin Masri
04-599 6018 |
| EEK 370 Economy and Management of Power System | 4 | II | **Energy Supply Economic**
Introduction economic engineering, economic aspect of power systems, brak-even point of the power plant, value decrease analysis of the equipment and component power system, profit index, demand and supply ratio.

Loads Forecast and Energy Cost
Loads characteristic, load growth forecast, supply and demand, structure and rate level, electric energy measurement, saving energy by supplier and consumer.

Power System Economic Operation
Principles of economic distribution, Scheduling of power generator units, losses in distribution and transmission lines, power system component, load sharing by power station

Power System Management
Power system management and optimization power gerating units, power auditing analysis, increase the quality of the power station, hormonics and their effects on power system.

Reliability in Power System
Probablity concept and reliability model, analytic method in probability, finding the chance value using probability distribution, finding reliability of the power system.

Laboratory

Using computer software to study economic dispatch and power system operation.

Assessment:
Coursework 40%,
Final Examination 60% | Dr. Ir. Syafrudin Masri
04-599 6018

Dr. Mohammad Kamarol Mohd. Jamil
04-599 6064 |

Course	Credit	Sem	Content	Lecturer
EEM 312 Robotics and Machine Vision	4	II	**Industrial Robot** Introduction, Types of Robot, Robotic Control System, Sensor and Actuator, Kinematics Analysis, Homogenous Transformation, Inverse Kinematics, Robot Work Cell Environment, Robot Economy, Industrial Applications. **Machine Vision** Introduction, Machine Vision Definition, Machine Vision or Human Vision, Usage and Requirements. **Image Sensor** Image Illumination, Focusing Mechanism, Sensor Element, Image types, Image for machine vision, Camera, Lenses, illuminations sequence, processing and storage hardware, Image processing software, digital image representation. Image processing algorithm, transformation method, Histogram, Filtering, Segmentation, Substraction, Averaging, Exapnsion and Edge Detection. **Analysis and Decision Making** Introduction to Statistical and Intelligent Methods, Examples of Machine Vision Application in the Industry. **Assessment:** Coursework 40%, Final Examination 60%	Dr. Khoo Bee Ee 04-599 6032 Assoc. Prof. Mohd. Rizal Arshad 04-599 6002
EEM 323 Instrumentation and Measurement Systems	3	II	**Advance Signal Analysis:** Signal representation, Fourier transform, Weiner- Khintchine transform, Parseval teorem, probability density function, power spectrum density, signal recovery, phase modulation, autocorrelation and cross correlation techniques, encoding and decoding techniques. **Mechatronic Measurement Systems** Flow measurement, heat transfer effect, ultrasonic measurement techniques, pressure measurement, torque and force measurement, strain measurement, vibration measurement, displacement, velocity and acceleration measurement. Chemical measurement systems: ph, resistivity, conductivity, principle of katharometer and anemometer measurement systems, fluid flow and viscosity measurement. **Data Acquisition System and Interfacing** Types of interfacing, serial interfacing, handshake, asynchronous technique,interfacing using RS232 and RS 448 systems. GPIB interfacing: GPIB bus structure, protocol, GPIB handshake, bus operation and implementation of the GPIB system. Data acquisition: important elements, types of wiring, single ended and differential inputs, implementation of data acquisition system and virtual instrumentation **Assessment:** Coursework 40%, Final Examination 60%	Prof. Mohd. Zaid Abdullah 04-599 1022
EEM 332 Design of Experiments	4	II	Introduction to basic principles and strategies of experimentation; Simple Comparative Experiments; Randomized Design; Paired Comparison Design;Experiments for Comparing Several Treatments; Random Effects Model; Fixed Effects Model; Completely Randomized Design; Randomized Complete Block Design, Multi-factor Experiments; Two-Factor Factorial Designs; General Factorial Designs; Two-Level Factorial Designs. **Assessment:** Coursework 40%, Final Examination 60%	Assoc. Prof. Zalina Abd. Aziz 04-599 6034

EEM 342 Mechatronics Laboratory II	3	II	Experiments with respects to topics in the following courses:-
			(1) Dynamics and Mechanics
			    - gear system
			    - cam and follower system
			    - mechanical power transmission
			    - dynamic and kinematic object
			(2) Drive and Actuator
			    - ac and dc machines
			    - stepper and servo motors
			    - hydraulic and pheumatic actuator systems
			    - electropheumatic and PLC
			(3) Integration of mechanical, electronioc and computer systems.
			
			Assessment:
			Coursework 100%
				Dr. Anwar Hasni Abu Hassan
				04-599 6031

EEM 348 Pronciple of Intelligent Systems	4	II	Intelligent Systems Concept Concepts of artificial intelligent systems including expert systems, neural networks, fuzzy logic, and genetic algorithms Technical Problem-Solving Problem-solving using intelligent engines and knowledge base for expert performance, problem taxonomy, approaches to automatically acquire knowledge from human experience, approaches to automatically explain problem-solving behaviours Intelligent System Analysis Using software packages for case studies including simulations and experiments of application of intelligent techniques to motor control systems, robotics, sensing, signal processing and analysis. **Assessment:** Coursework 40%, Final Examination 60%	Assoc. Prof. Umi Kalthum Ngah 04-599 6022 Dr. Shahrel Azmin Suandi 04-599 6018
EEE 429 Computer Systems and Multimedia	4	I	Personal Computer Architecture: Central Processing Unit (CPU), high performance microprocessor (32/64 bit superscalar) High Speed Bus System: Hierarchical Bus structures, Peripheral Component Interconnect (PCI) bus specifications Memory System: Implementation of main memory using DRAM, concepts and the implementation of cache memory Multimedia Implementation: Graphics system design, sounds and video, CD-ROM interface Network Facilities: Ethernet Facilities, MODEM, Universal Serial Bus (USB), Firewire Operating System: Basic structure, scheduling, memory management, Disc Operating Sytem (DOS), Windows and UNIX Parallel Architecture: Multiple Processes, cache memory uniformity and MESI protocol, vector computation, parallel processing **Assessment:** Coursework 30%, Final Examination 70%	Assoc. Prof. Junita Mohamad Salleh 04-599 6027 Dr. Haidi Ibrahim 04-599 6606
EEE 430 Software Engineering	4	I	Introduction to Software Engineering Scope of Software Engineering – the software crisis, principles of software engineering. Software Process – the software lifecycle, the waterfall model and variations, spiral model, risk driven approaches, evolutionary and prototyping approaches. Project Managements – project planning and estimation, risk analysis and management, cost model, version control, configuration managementTesting – testing process, strategies, and techniques. Maintenance – corrective maintenance, perfective maintenance, adaptive maintenance Object-Oriented Concepts and Principles The Concept of Objects. The Unified Modeling Language (UML). Object-oriented Analysis and Design – requirement and specification, analysis and design, implementation, integration Mini Project The application of the object-oriented principles **Assessment:** Coursework 40%, Final Examination 60%	Assoc. Prof. Kamal Zuhairi Zamli

| EEE 443
Digital Signal
Processing | 3 | I | **Review of Signal and Discrete-Z Time System**
Z- transform and its applications and analysis of the linear invariant time system. Discrete time frequency analysis and Fourier transform of discrete signals and their bahaviours. Frequency domain characteristics of inear time invaraiant system and its applications.

Discrete Fourier Transform
Frequency domain sampling, discrete Fourier transform as linear transform. Behaviours of discrete Fourier transform. Circularly symmetry. Methods for linear filtering using discrete Fourier transform. Signal analysis in frequency domain using discrete Fourier transform.

Fast Fourier Transform (FFT)
Split and rule method. Radix-2 FFT algorithm, Radix-4 FFT algorithm, Quantization effect on the computation of discrete Fourier transform.

Structure of FIR system
Direct shape I and II, cascade, parallel shape and lattice structure, state space structure, representation of numbers, quantization of coefficient filters, round-off effects in digital filters,

Design of FIR filters
Causality and its applications, Symmetrical and non-symmetrical FIR filters, linear phase filters using windows, linear phase filters using frequencys ampling

Design of IIR filters
Design of IIR filters based on derivative approximation, invariant impulse and linear transform. General characteristics of analog filters and frequency transform.

Assessment:
Coursework 30%,
Final Examination 70% | 👤 Dr. Sharel Azmin Suandi
📞 04-599 6018 |
| EEE 445
Design of
Intergrated
Analog Circuits | 4 | I | **Bipolar Analog IC Design**
Emitter-Coupled Pair, Active-Load Current Mirror, Voltage and Current Reference Design, Band-Gap Voltage Reference, Monolithic Operational Amplifier Design, CMMR, Input Offset Voltage and Current, Gain Feedback Unit, Noise in Monolithic Operational Amplifier, Two-Quadrant and Four-Quadrant Analog Multipliers, Bipolar Voltage-Current Converter.

MOS Analog IC Design
Circuit- MOS Bias Circuit, MOS Voltage Divider, MOS Current Mirror, Wilson Current Source, MOS Dynamic Current Mirror, CMOS Voltage Reference Circuit, Transconductance Amplifier. NMOS,CMOS, BiCMOS Operational Amplifier Design, MOS Level Shifter, MOS Output Stage, Frequency Response, Phase Margin, Slew Rate, Noise in MOS Amplifier, Noise Performance, CMMR, PSRR, MOS Four-Quadrant Multiplier.

MOS Sub-System Analog Design
MOS Sample and Hold Circuit, MOS Amplifier, Clock Feedthrough Effect. Principles of MOS Switched-Capacitor, A/D and D/A Converters. High Frequency Sense-Amplifier Circuit for Memory System, VLSI MOS Analog Basics in Signal Processing and Communication.

Projek – CMOS Operational Amplifier Design

Assessment:
Coursework 40%,
 Final Examination 60% | 👤 Assoc. Prof. Tun Zainal Azni Zulkifli
📞 04-599 6018 |

| EEE 449
Computer
Networks | 3 | I | **Introduction**
Computer communication revolution, network and data communication, computer communication architecture, communication standards, Opens System Interconnection (OSI) model and ISO reference model

Data Communication
Synchronous and Asynchronous data, error detection techniques, interface, multiplexing and data link control

Computer Networking
Protocol and layered architectures, Open System Interconnection(OSI) Model, Local Area Network (LAN) topologies and communication medium, Medium Access Control (MAC), Wide Area Network (WAN), Integrated Services Digital Network (ISDN) and inter-network system: Internet Protocol (IP) and TCP/IP architecture.

Open System
TCP/IP and OSI protocol, transport and protocol operation. Example; MAP and X400.

Introduction to Electronic Mail, World Wide Web

Assessment:
Coursework 30%,
Final Examination 70% | Mr. Mohd. Nazri Mahmud
04-599 6059 |
| EEE 453
Control System
Design | 4 | I | **Review of Basic Control Systems**
Laplace and Z transforms, transfer functions and system stability. Time and frequency response, root locus, Bode diagram and Nyquist plots.

State-space Variable and State-space Modelling of Dynamical Systems
State-space concept, state equation and state space representation. System modes, modal decomposition and transition matrices. Controllability and observability. Stability and stabilisability.

Control System Design using State-space Method
Pole placement and Ackermann's formula. Estimator design: prediction, current and reduced order. Controller design: separation principle, full state feedback, state control and integral control.

System Identification
Identification process, type of input signals, type of models, nonparametric identification, parametric identification, parameter estimation: Least Squares (LS), recursive LS, stochastic LS algorithm and maximum likelihood – numerical sequence, application examples.

Introduction to Optimal Control
Optimization principle, Pontryagin's minimum principle, steady state optimal control with LQR.

Introduction to Advance Control Techniques
Adaptive, fuzzy and neural network control systems.

Laboratory
Simulation of state equation representation, design of state feedback controller, design of state estimator, system identification LS, IV and RLS, design of optimal controller LQR.

Application of MATLAB and SIMULINK

Assessment:
Coursework 40%,
Final Examination 60% | Prof. Lim Chee Peng
04-599 6033

Dr. Rosmiwati Mohd. Mokhtar
04-599 6056 |

| EEE 470 Modern Communication Systems | 4 | I | Part 1- Optical Fiber Communication
Introduction to Optical Fiber Communication:
Student will be exposed to the historical development of optical fiber and basic system for optical communication. Also the need of optical communication compared to the usage of copper wire.

Optical Communication Channel
This topic will cover the attenuation in optical fiber which limit the distance of an optical channel transmission line. Types of optical fiber will be explained such as single mode and multi-mode.

Optical Source for Optical communication.
This section will expose the student to the structure and operational method of optical sources and also types of optical sources that commonly used such as LASER and LED.

Optical detection and Receiver
Student will be introduced to the optical receiver and detection that available in the market. Apart from this, the effect of noise on receiver and detection will also be clarified.

Part 2- Cellular Telephone System
Introduction to Cellular Telephone System
Students are exposed to the concept and evolution of cellular telephone system.

Cellular Telephone Concept
This section will describe the application of frequency reuse, interference, cell division, sector, segment and binary. Apart from that, the students will be exposed to the topology of cellular system and rooming.

Cellular Telephone System
Student will be explained the first generation the analogue cellular telephone system, PCS, GSM and 3G.

Part 3- Satellite Communication
Introduction to Satellite Communication System
Historical of satellite communication system, Kepler law, satellite orbits, GEO and LEO satellite will be explained.

Satellite Antenna
Types of antenna, radiation pattern of satellite antenna.

Link budget
Satellite link model, satellite system parameters, link equation

Multiple accesses
FDM/FM satellite system, multiple accesses, channel capacity.

Assessment:
Coursework 40%,
Final Examination 60% | Dr. Widad Ismail |
| EEK 464 High Voltage System | 3 | I | Introduction:
System voltages; HV phenomena; basic principles and components of protection; operational and constructional features of relays.

High Voltage Technology
Influence of electric fields on power system equipment design; environmental effects of overhead HV lines; voltage distribution and breakdown voltage of insulators; pollution and aging effect on insulators; protection measures against lightning over voltages; insulation co-ordination; earthing principles.

Relays
Characteristics and applications; static relays (classification and basic components); comparators; static relays in protective schemes.

Feeder Protection
Apparatus of protection; auto-reclosing (single and 3-phase); testing and maintenance of switchgear.

Circuit Breakers
Theory of circuit interruption; circuit constants relating to circuit breakers; theory and practice of conventional circuit breakers; advances in circuit breakers; testing of circuit breakers.

Laboratory: Experiments on relays and protection systems.

Assessment:
Coursework 40%,
Final Examination 60% | Dr. Mohammad Kamarol Mohd. Jamil
04-599 6064 |

Course	Unit		Syllabus	Lecturer
EEK 470 Electrical Power Distribution System	4	I	**Fundamental Consideration** Classifications of utility loads, brief review on distribution transformer and power factor correction using capacitans, utility factor, general distribution system and various voltage levels. **Design of Subtransmission Line and Distribution on Substation** Subtransmission line, substation rating, service area, voltage drop and voltage regulation, K factor and substation grounding. **Design of Main Distribution System** Discussion on various types of feeders (radial, loop, network), voltage levels, system growth scheme, radial feeders with uniformly distributed loads and non-uniformly distributed loads (increasing linearly) and examples of radial main distribution system design. **Secondary Distribution System Design** Discussion on secondary feeders, voltage levels, secondary networks, economic considerations of secondary system design and imbalanced loads and voltages. **Voltage Drop and Power Loss Calculation** Balanced three-phase and non three-phase main system, four-wire three-phase multigrounded system and feeders cost analysis. **Voltage Regulation of Distribution Systems** Service quality and voltage standard, the need for regulation commission, voltage control, voltage regulator and tap-changers, applications of regulator and capacitors and voltage profiles. **Distribution System Protection** Discussion on protection concepts, typs and characteristics of protection devices, protection devices coordination, lightning and substation protection and fault currents calculations. **Laboratory** Application of simulation and software packages in regulation study (profiles) for distribution systems, experiments on balanced and imbalanced loads for 3-wire and 4-wire three phase systems and coordination of system protection. **Assessment:** Coursework 40%, Final Examination 60%	Dr. Ir. Syafrudin Masri 04-599 6018
EEK 471 Advanced Power Electronic	3	I	**Controlled Rectifiers** Single phase half wave and full wave diode rectifier, single phase and full wave controlled rectifier, power factor, harmonic for inductive and resistive load, dc load, multiphase rectifiers. **AC Voltage Controller** Duty cycle control, single phase control resistive load and inductive load, multiphase ac controller with resistive and inductive load, transformer tap changers, cycloconverter, design of ac voltage controller circuit. **Inverter** Single phase inverter operation, single phase half bridge and full bridge inverter, voltage control of single phase inverter, multiphase inverter, inverter switching circuits. **DC to DC Converter** Control dc converter, step down operation, step up chopper, Buck-Boost chopper, Cuk chopper, chopper circuit design, chopper comparisons. **Resonant Converter** Types of resonant converter, basic concept of resonant circuits, resonant load, zero voltage switching (ZVS), zero current switching (ZCS). **Power Supplies** DC power supply-switched mode dc, resonant and bidirectional. AC power supplies- switched mode ac, resonant and bidirectional. **Simulation** Use PSPICE and PESIM package to design rectifier, inverter and chopper circuits. **Assessment:** Coursework 40%, Final Examination 60%	Assoc. Prof. Soib Taib 04-599 6012

EEK 472 Power System Analysis	3	I	Basic Principles of Power System Analysis: Power on Three-Phase System, Complex Power, Per-Phase Analysis, Power Factor Correction. Single Line Diagram of the Power Network, Per Unit System. Power System Parameter and Modelling: Synchronous Generator Model and Parameters, Model and Parameter of Transformers, Transmission line Parameters (R, L and C), Transmission line Models (Short, Medium and Long Models), Loads Model. Power Flow Analysis: Power System Representative, Bus Admittance Matrix, Gauss-Seidel Iterative Solution and Newton-Raphson Method for Power Flow analysis. Fast Decouple Power Flow Solution. Fault and Short Circuits Analysis: Transient Phenomena, balanced Fault, Short-Circuit Capacity (SCC), Bus Impedance Matrix, Symmetrical Components, Sequence Impedance and Networks, Unbalance Faults and Short Circuit Analysis (L-G, L-L, L-L-G and 3-phase Faults). Transient and Stability Analysis: Swing Equation, Synchronous Machine Model For Stability Analysis, Steady-State Stability For Small Disturbances, Transient Stability Equal Area Criterion. Laboratory Experiments and simulation conducted to power system analysis (Generator, transformer, transmission, loads, real power, reactive power, complex power, power flow analysis, faults analysis and transient stability analysis. **Assessment:** Coursework 40%, Final Examination 60%	👤 Assoc. Prof. Soib Taib 📞 04-599 6012
EEK 474 Electrical Machine Design	4	I	Introduction Design consideration, design factors, design limitations, trends in design of electrical machines, modern electrical machine manufacturing techniques Engineering Materials for Electrical Machine: Properties and characteristics: Electrical conducting materials , soft magnetic materials, hard magnetic materials, electrical insulation materials Heating and Cooling of Electrical Machines Heat dissipation: conduction, radiation and convection; Cooling: terminologies, method of cooling(natural cooled, forced cooling etc.); Temperature rise: time constant, steady state temperature rise; Rating of electrical machine: power ratings, types of duties and ratings, ambient temperature and rating, overload capacity of machines, rapid heating of conductor. Magnetic Circuit Basic principles of magnetic circuit, magnetization curve, leakage and coupling field, flux and inductance, B-H curve of permanent magnet, load line and working point Winding Design Types of winding configuration: concentrated, distributed, overlapping and non-overlapping windings, MMF and EMF of winding, winding factors: chording, distributing and skewing factors, torque constant and EMF constant, construction, packing factor, end windings Case studies: Design examples Transformer, Permanent magnet brush less motor **Assessment:** Coursework 40%, Final Examination 60%	👤 Dr. Dahaman Ishak 📞 04-599 5810
EEM 441 Instrumentation and Control Laboratory	2	I	To conduct experiments on application of various instrumental and control techniques. **Assessment:** Coursework 100%,	👤 Prof. Mohd. Zaid Abdullah

EEE 446 IC Testing and Measurement	4	II	Introduction to test and Measurement Techniques The correct way to test, device under test and test engineering. Devices Specification Basic terminologies, test specification versus test condition, verying functional parameters Test and Verying DC and AC Parameters Open short test, DC parametric, AC parametric and Noise measurement and ripple noise. Device Characterization and Prototyping Test vector and characterization setup, defining characterization from test and measurement data, common characterization parameters, data logger and data crunching, characterization model and statistical analysis, schmoo plots, data justification and correlation, DSM modeling and finalize device specification. **Assessment:** Coursework 40%, Final Examination 60%		Assoc. Prof. Tun Zainal Azni zulkifli 04-599 6010 Mr. Zulfiqar Ali Abd. Aziz 04-599 6065
EEM 421 Quality Techniques	4	II	Definitions and Meanings of Quality; Basic Concepts of Quality; Quality System; Seven Basic QC Tools; Seven New QC Tools; Failure Mode and Effect Analysis; Statistical Process Control; Statistical Acceptance Sampling; Process Capability Analysis; Deming Cycle; Quality Costs; Case Studies **Assessment:** Coursework 40%, Final Examination 60%		Assoc. Prof. Zalina Abdul Aziz 04-599 6034
EEE/EEK/EEM 499 Undergraduate Project			A small scale research project will be undertaken by every final year student. The aim of the project is to introduce them some problems related to engineering and accustomizing them with the techniques of investigation, solving the problems , writing a technical report and present the results in the form of thesis and seminar. **Assessment :** Coursework 100%		Dr. Zuraini Dahari 04-599 6048

Course Code/ Title	Unit	Semester Offered	Synopsis	Details of Lecturer
EBB 113 Engineering Materials	3	I	The course is an introductory course on engineering materials which is divided into three main parts. The first part includes the classifications of materials that determine their applicability, the structure of the materials explained by the quantum-mechanical principle that relates electrons to energies, bonding scheme of different materials, the structure of crystalline solids and introduction to imperfection in solids. The second part covers the mechanical characteristics of materials for service use and methods of assessing the mechanical characteristics of materials. The second part also includes the behaviour of material in thermal equilibrium (free energy concept, phase transformation and examples of phase diagrams), diffusion mechanisms and usual causes of failure in a given material. The third part is on application and processing of specific material (metals, ceramics and polymer). Introduction of electrical, magnetic and optical properties of materials is also presented in the course. In general, this introductory materials science and engineering course deals with the different material types (i.e., metals, ceramics, polymers, composites), as well as the various kinds of properties exhibited by these materials (i.e., mechanical, electrical, magnetic, etc.) which intended to equip the students with necessary knowledge on material science and engineering. **Assessment:** Coursework 30%, Final Examination 70%	Assoc. Prof Ir. Cheong Kuan Yew 04-599 5259 cheong@eng.usm. my Dr. Julie Juliewatty Mohamed 04-599 5266 srjuliewatty@eng. usm.my Dr. Shah Rizal Kasim 04-599 6172 srshahrizal@eng. usm.my Dr. Srimala Sreekantan 04-599 5255 srimala@eng.usm. my Dr. Yeoh Fei Yee 04-599 6175 srfeiyee@eng.usm. my Dr. Zainovia Lockman 04-599 6178 zainovia@eng.usm. my

EBB 155 Engineering Materials Introduction Laboratory	2	I	The course is an introductory course on experimental method related to the basic principles of materials. It consists of ten set of different experiments which the student has to carry out with the assistance of lecturer and technical staff. Students are divided into small group and hands-on experiments are performed. Students are required to record, measure, calculate the result and finally write and submit a report at the end of each session. Each experiment covers various aspects of materials (i.e. metal, ceramics polymers and composites). Safety aspects and regulations on conducting scientific experiments are also briefed and taught. Practical related to basic principal of Materials Science. • Identification of engineering materials and function of reinforcement fiber in composite system • Atomic arrangement of solid and Miller lattices • Measurement of porosity and density of materials • Fluid mechanics • Densification of powder materials • Introduction to optical microscope and its application • Introduction to electronic materials and devices • Measurement of electrical conductivity and semiconductor extrinsic materials • Qualitative analysis of using x-ray diffraction technique and using x-ray with Debye-Scherrer • Electrochemistry: Galvanic cell versus electrolyte cell • Particle size distribution using Andreason pipette • Study of plasticity of clay and determination of Atterberg's Plasticity index **Assessment:** Coursework 100%	Dr. Hasmaliza Mohamad 04-599 5263 hasmaliza@eng.usm.my
EBB 160 Engineering Physical Chemistry of Materials	3	II	Introduction to Thermodynamics First Law of Thermodynamic; Expansion and compression work; enthalpy, heat capacity; thermochemistry and its application in metallurgy. Second Law of Thermodynamics Differential functions of entropy and cyclic process. Thermodynamics relation involving Free Energy. Relationship between equilibrium constant and reaction temperature. Kinetics of Reaction Effects of reactant concentration. Quantitative relationship between rate of reaction and concentration of reactant. Determination of reaction order and rate constant. Effect of temperature on rate of reaction. Absolute rate of reaction. Catalysis. Diffusion in solids. Electrochemistry Electrolytes, conductance in electrolytes. Electrode potentials. Galvanic cell. Measurement of cell e.m.f and electrode potentials. Oxidation and reduction potentials. Standard Electrode Potentials Series. Interfacial Phenomena Surface energy and surface tension. Interfacial energy other than gas/liquid. Adsorption and colloids. **Assessment:** Coursework 30%, Final Examination 70%	Dr. Yeoh Fei Yee 04-599 6175 srfeiyee@eng.usm.my Prof. Zakaria Mohd. Amin 04-599 6117 srzakaria@eng.usm.my
EBS 101 Engineering Geology	3	I	Introduction to geological principles with emphasis on the application for the purpose of finding solutions to engineering problems. Chemical and physical properties of the earth and the internal structure of the earth. Geological time scale and method to determine geological age. Internal and external processes. Magma activities, earthquake, volcanoes, metamorphism. Weathering, erosion and gravity action. Mineral and rock identification according to its types - igneous rock, sedimentary rock and metamorphic rock. Geological structure, joint, fault, discontinuity, unconformity, fold and strata. Geological map. Use and interpretation. Apparatus used. Plate tectonic theory. Continent drift, opening and closing of ocean, convection current. Formation of mountains and other earth landforms. Engineering properties on rocks, basics on the stability of slope and tunnels. **Assessment:** Coursework 40%, Final Examination 60%	Tuan Besar Tuan Sarif 04-599 6158 tuan@eng.usm.my Dr. Hareyani Zabidi 04-599 6124 srhareyani.zabidi@eng.usm.my

EBS 110 Engineering Drawing	2	I	Introduction to engineering drawing. Orthographic and isometric drawing: projection isometric drawing, sectional drawing, and auxiliary view. Working drawing: introduction to assembly drawing, detail drawing and material list, blue print reading. Drawing practice for engineering diagrams: block diagrams, flow diagrams, auxiliary diagrams. Intersections: between two cylinder and cone, between cylinder and sphere. Introduction of computer aided design (CAD). **Assessment:** Coursework 100%	Dr. Samayamutthirian Palaniandy 04-599 6132 samaya@eng.usm.my
EBP 103 Polymer Organic Chemistry	3	I	Carbon compound and chemical bonds. An introduction to organic reactions: acids & bases. Alcohols and ethers, Aromatic compounds. Reactions of aromatic compounds, Carboxylic acids and their derrivatives. Amines, Phenol and aryl halides. Free radical reactions, simple molecules and polymers. Ionic reactions, simple molecules and polymers. General reaction in polymers; epoxy, poliester, alkid resin, polyurethane. **Assessment:** Coursework 30%, Final Examination 70%	Assoc. Prof. Chow Wen Shyang 04-599 6160 shyang@eng.usm.my Dr. Zulkifli Ahmad 04-599 6183 zulkifli@eng.usm.my
EBB 202 Crystallography and Bonding in Solids	3	I	Application of symmetry elements and method of indices - Presentation of angular and directional data in crystallography using stenographic Projection. Principles and practice of X-ray diffraction for study and crystalline of powder photographic technique for identification of materials, Laue photographic technique for the identification of orientation in single crystals. Method for determination of strain, particle size, crystal imperfection and texture. Introduction to crystal chemistry for metals, polymers, simple ionic and covalent components with emphasis on structure - property relationship. p1p Types of chemical bonding in different kinds of materials stability of ionic solids from crystal energy consideration and concept of electronegativity, principles of wave mechanics. Geometry of molecular and directional bonding VSEPR (Valence shell Electron Pair Repulsion), Dipole moment and molecular geometry theory valence boundary. **Assessment:** Coursework 30%, Final Examination 70%	Dr. Ahmad Azmin Mohamad 04-599 6118 azmin@eng.usm.my Dr. Nurulakmal Mohd. Sharif 04-599 6180 nurul@eng.usm.my
EBB 204 Materials Characterisation Laboratory	2	II	Practical related to mechanical properties of materials and their testing methods. • Properties of glasses and failure of brittle materials • Resistant measuring by Van der Pauw method • Slag attacks on refractory materials • Structural changes and properties of weldable mild steel • Corrosion of steel in various solutions • Tensile test • Hardness test • Flexural test • Fatigue and impact tests • Thermal expansion test **Assessment:** Coursework 100%	Dr. Khairunisak Abdul Razak 04-599 6126 khairunisak@eng.usm.my

| EBB 212 Raw Materials and Structural Ceramics | 4 | II | Introduction to ceramics: To have an idea about the various ceramic fabrication techniques and their properties including a brief explanation on ceramic research and developments, classification at ceramic products and their properties. Knowledge about ceramic raw materials either from natural resources or syntheses. Clay is the most important example besides alumina from Bayer process and magnesia from sea water.

Ceramic Raw Materials: Clays (geology, mining & beneficiation, structure of silicate compounds, characterization of china and ball clay, plasticity, heat reaction on clay), Silica, Limestone, Feldspar and other materials important to ceramic industries.

Preparation of raw materials: crushing, grinding, sizing, classification and processing; characterization and analysis of powder and ceramic products. Understanding about various term such as particle, agglomerate and aggregate. Various shape - spherical, rod and platy. Various characterization technique to determine size and size distribution of particles - Andreason pipet, sedigraph, microscopy, laser diffraction.

Milling process: Milling actions - crushing, impact and friction with abrasion. Various type of milling machine - classified according to their milling action. Milling media. Open and close circuits milling processes.

Mixing of ceramic powders - various mixing techniques (dry powder, paste, slurry). Spray dryer. Structural ceramics product - various application such as bricks, tiles and roofing tiles.

Cement and concrete - definition, important compounds in Portland cement, the production, hydration process and determination of the properties.

Assessment: Coursework 30%, Final Examination 70% | Dr. Hasmaliza Mohamad 04-599 5263 hasmaliza@eng.usm.my

Dr. Julie Juliewatty Mohamed 04-599 5266 srjuliewatty@eng.usm.my

Prof. Zakaria Mohd. Amin 04-599 6117 srzakaria@eng.usm.my |
| EBB 215 Semiconductor Materials | 3 | II | Basic electrical concepts - electrical field, potential, current density, Gauss law, Poisson equation, Ohm law. Introduction to semiconductor - resistivity, crystallinity and band gap. Unit cell, lattice type, packed arrangement, zinc blende structure etc.

Atomic structure, Bohr concept, problems with classical theory, explanation on electron wave behaviour, quantum principle. Energy Band Theory: Charged particles, potential - energy barrier, atomic characteristics, Brillouin zone and atomic energy level, electronic structure of group IVA elements (e.g. Si and Ge), energy band of insulator, semiconductor and conductor, crystalline structure and valence model for intrinsic and extrinsic semiconductors, materials for semiconductor.

Fermi level, equivalent concentration between holes and electrons, invariance of Fermi level. Transport phenomena in semiconductor; mobility and conductivity, carrier densities in semiconductor, impurities in equilibrium, Hall effect, generation, recombination and carrier injection, Einstein equation.

Junctions formation, contact potential, methods for junction formation. P-n junction, dc and ac diode analysis, IV characterization, junction capacitance, switching, junction of metallic semiconductor - Schottky barrier, Ohmic contact.

Assessment: Coursework 30%, Final Examination 70% | Dr. Zainovia Lockman 04-599 6178 zainovia@eng.usm.my

Dr. Khairunisak Abdul Razak 04-599 6126 khairunisak@eng.usm.my |

EBB 220 Engineering Polymers	3	II	Introduction to various polymers especially on classification aspects and methods of polymerization. Relationship between structures, properties and application as engineering materials with specific conditions. Examples of commercially available polymeric materials - thermoplastic and thermoset for general and engineering applications. Basic concepts for modification of polymers via homogenizing with various additives such as plasticizer and stabilizer etc. Toughening and strengthening in polymer composites - various type of reinforcement such as fibre, wisker compared to normal filler and particulate. Various processing technique such as extrusion, blow film. Factors that controlled the quality of products. Introduction to rheology properties and its importance to processing. Various technique to measure rheology. Concept of viscoelastic of polymeric materials in the form of solid or melt. Dependability concept - properties/time/ temperature with master curve in design. **Assessment:** Coursework 30%, Final Examination 70%	Assoc. Prof. Mariatti Jaafar 04-599 5262 mariatti@eng.usm.my Assoc. Prof. Hazizan Md. Akil 04-599 6161 hazizan@eng.usm.my
EBB 222 Physical Metallurgy	4	II	Physical Metallurgy - Crystal structure and properties of pure metal. Solidification; Plastic Deformation Strengthening Mechanisms, solid solution strengthening; Deformation strengthening. Dispersion strengthening/hardening. Order-disorder strengthening/hardening. Recovery, Recrystallization and grain growth; iron-carbon diagram; TTT diagram hardenability; heat treatment of steel, non-ferrous metals and alloy. Heat treatment for non-ferrous metals. Metals and alloys for high temperature and low temperature applications. Cast iron and stainless steel. **Assessment:** Coursework 30%, Final Examination 70%	Dr. Zuhailawati Hussain 04-599 5258 zuhaila@eng.usm.my Mr. Ahmad Badri Ismail 04-599 6107 badri@eng.usm.my
EBB 236 Materials Thermodynamic	3	I	Brief review of thermodynamic principles, phase transformation, solid state reaction. Thermodynamic phase diagram, Free energy consideration. Transformation kinetic. Thermodynamic and kinetic in glass forming system, precipitation of different phases with different composition and matrix. **Assessment:** Coursework 30%, Final Examination 70%	Dr. Julie Juliewatty Mohamed 04-599 5266 srjuliewatty@eng.usm.my Dr. Projjal Basu 04-599 5261 projjal@eng.usm.my Dr. Srimala Sreekantan 04-599 5255 srimala@eng.usm.my

Code	Units	Sem	Description	Lecturer
EBB 245 Characterisation of Engineering Materials	3	I	Concepts in chemical analysis. Classic method of analysis. Spectrometry method Spectrometric methods of atomic adsorption. X-ray Frourescence (X-ray diffraction distance wave) **Assessment:** Coursework 30%, Final Examination 70%	Assoc. Prof. Hazizan Md. Akil 04-599 6161 hazizan@eng.usm.my Dr. Hasmaliza Mohamad 04-599 5263 hasmaliza@eng.usm.my Dr. Zuhailawati Hussain 04-599 5258 zuhaila@eng.usm.my
EBB 250 Computer Methods for Engineers	2	I	Introduction to computer programming and operational systems. Introduction to Visual Basic V6, intrinsic control, procedure and type of data, debugging tools, menu box and dialog, data base function in visual basic application office, multiple document interfaces. Introduction and basic of excel software. Function applications, charts. Application: curve fitting, user define function, modeling, equation solving, numerical integration and differentiation. **Assessment:** Coursework 100%	Mr. Ahmad Badri Ismail 04-599 6107 badri@eng.usm.my
EBS 201 Mineral Deposits	3	I	Morphological properties of ore bodies. Textural and structural properties of ore and gangue minerals. Fluid inclusions. Geothermometry and geobarometry. Paragenesis sequence. Zoning. Regional and metallorgraphy epoch. Theories on ore genesis. Sulphide stratiform deposits: Pb-Zn stratabound deposits. Alluvial deposits (Au, Sn) including paleoplacer. Banded iron formations. Manganese, phosphate and evaporate deposits. Coal. Residual deposits. Secondary enrichment. Raw materials: ceramic and construction. Sulfide deposits. Stratabound volcanogenic massive. Porphyry Copper. Quartz veins hydrothermal deposits (gold, tin, uranium, copper). Contact metamorphism and metamorphic deposits. **Assessment:** Coursework 40%, Final Examination 60%	Tuan Besar Tuan Sarif 04-599 6158 tuan@eng.usm.my
EBS 209 Mineralogy	3	I	Introduction to minerals and crystals, crystalline and non-crystalline solids. An understanding of bonding forces in crystals and principles governing the arrangement of atoms in crystal structure, calculation of chemical formula, compositional variations in minerals caused by atomic substitution. Polymorphism and pseudomorphism. Physical properties and their correlation with ionic bonding. Classification and the description of important mineral classes. Introduction to instrumental analytical techniques. **Assessment:** Coursework 40%, Final Examination 60%	Dr. Kamar Shah Arifin 04-599 6116 kamarsha@eng.usm.my Dr. Hareyani Zabidi 04-599 6124 srhareyani.zabidi@eng.usm.my

EBS 210 Mining Engineering Laboratory	2	II	Fundamental experiments for Mining Engineer and exploration geologist in aspects of Geophysics: Resistivity and seismic survey: Refraction and reflection seismic. Data and interpretation and their relationship to the geological features.	Dr. Samayamutthirian Palaniandy
			Mining Engineering: Environment. Engineering, Mine Ventilation, Sound & dust controls. Ventilation system.	04-599 6132
			Geotechnique: Determination of physical and mechanical properties & parameters of soils and rocks. Uniaxial and Triaxial strength tests of soil and rock specimens. Direct shear test of unconsolidated soil, soil compaction test and permeability test.	samaya@eng.usm.my
			Simulation in Mining: Economic evaluation of deposits, mine designs, planning, control, monitoring and logistic.	
			Fluid Mechanics: pump performance: Centrifugal pump tests either in a single, parallel or series arrangement. Manually or computerization, pipe losses test.	
			Assessment: Coursework 100%	
EBS 215 Comminution and Sizing	3	II	Basic ideas, stages and operations in mineral processing. Liberation, concentration process and material balance.	Prof. Khairun Azizi Mohd. Azizli
			Size reduction processes. Crushers - primary and secondary. Grinding - ball mills, rod mills, autogeneous and other grinding methods. Closed circuit crushing and grinding. Energy in comminution. Determination of Bond Work Index. Comminution circuit design.	04-599 5231 khairun@eng.usm.my
			Sizing. Laboratory sizing methods. Screening. Screening methods in industry. Screening efficiency. Partition Curve.	Assoc. Prof. Hashim Hussin
			Classification - basic laws. Sorting and sizing. Types of classifiers. Cyclones. Efficiency of classification processes.	04-599 6114 hashim@eng.usm.my
			Assessment: Coursework 40%, Final Examination 60%	Dr. Syed Fuad Saiyid Hashim
				04-599 6181 mesyfuad@eng.usm.my
EBS 219 Introduction to Mining Engineering	3	II	**Introduction** The purpose of mining and mining operation in Malaysia. The terms used in mining. The existing laws related to mining and quarrying.	Prof. Dato' Ir. Eric Goh
			Exploration Basic geology, ore occurrence in the rocks and the methods employed in exploration.	04-599 6112 eric@eng.usm.my
			Ore evaluation Sampling and usage of Banka drill. Simple calculation of ore reserves using weighted average and statistical methods.	
			Mining and Quarrying Introduction to surface and underground mining methods: dredging, gravel pumping, panning, open cast and basic method in underground mining. Quarrying operation. Basics in soil and rock classification. Mineral processing in brief.	
			Drilling Drilling equipment used in mining and quarrying: hammer drill, rotary drill.	
			Explosives Basic types and usage of explosives in mining and quarrying.	
			Assessment: Coursework 40%, Final Examination 60%	

EBS 238 Fluid Mechanics	3	I	Basic information on characteristics of floating bodies, forces when constant linear acceleration and constant rotational acceleration is applied. Fluid kinematics, momentum and Bernoulli equation and flow measurements. Boundary layers, control and separation, lift and drop forces. Flow in pipes, pipe network analysis. Flow in open channel, critical flow and normal flow, hydraulic pump, fully developed flow that varies gradually. Hydraulic machines and pressure changes in pipes. Dimensional analysis, similarity models and hydraulic models. Hydraulic machine, impulse turbines, reaction turbines and centrifugal pump. Pressure change in pipes, simple methods, surge tank. **Assessment:** Coursework 40%, Final Examination 60%	Dr. Syed Fuad Saiyid Hashim 04-599 6181 mrsyfuad@eng.usm.my Dr. Yeoh Fei Yee 04-599 6175 srfeiyee@eng.usm.my
EBS 242 Petrography & Ore Microscopy	3	II	To equip students with a broad techniques and methodologies in mineral and rock identification and classification by petgrophics study for most of the silicate minerals and ore microscopic study for metallic mineral using polarized microscope (petrographic microscope). Familiarized with petrographic identification, and classification techniques (textural and composition) of various igneous (including pyroclastic rock), sedimentary rock and metamorphic rocks. Provide broad knowledge of microscopic study of metallic ore that have economic important and process mineralogy (mineral processing) and other geological paragenesis study of the ore occurrence **Assessment:** Coursework 40%, Final Examination 60%	Dr. Hareyani Zabidi 04-599 6124 srhareyani.zabidi@eng.usm.my
EBP 200 Polymeric Materials	3	I	Introduction to polymer engineering: basic concept of polymer engineering and polymer classification, polymer synthesis and structure, polymer molecular weight, polymer transition, polymer chain flexibility, morphology and polymer viscoelastic properties, mechanical and thermal properties of polymer. Introduction to types of polymer: rubber, latex, plastics, composite, fibre, textile etc. General applications of engineering polymer: rubber, latex, plastics, composite, fibre, textile etc. **Assessment:** Coursework 30%, Final Examination 70%	Assoc. Prof. Azlan Arifin 04-599 6176 azlan@eng.usm.my Dr. Azura A. Rashid 04-599 6111 azura@eng.usm.my
EBP 201 Polymer Synthesis	3	I	Types of polymer and long chain average number concept. Condensation polymerization: mechanism and kinetics. Addition polymerization: free radical, cationic and anionic; mechanism and kinetics. Coordination and ring opening polymerization. Polymerization technique/system: bulk, solution, gas-phase, suspension, emulsion. Copolymerization: Copolymer equation, reactivity ratios, random copolymer, block copolymer and graph copolymer. General polymer reaction: isomerism, cyclic, halogenations epoxidation, etc. Polymer degradation: thermal, mechanical, radiation, hydrolysis, oxidation etc. **Assessment:** Coursework 30%, Final Examination 70%	Dr. Zulkifli Ahmad 04-599 6183 zulkifli@eng.usm.my
EBP 202 Polymer Structure	3	I	Polymer structure: morphology, crystallization and crystal imperfections. Polymer chain flexibility, conformation, configuration. Statistic analysis for polymer chain. Amorphous state - 5 region for viscoelastic behavior, factors that influenced Tg, glass transition theories, secondary transition and methods for polymer transition measurements. Crystal state - polymer crystal structure and polymer melting. Molecule orientation - cause and measurement of molecule orientation and morphology. Polymer microscopy, various microscopy technique such as electron microscopy and X-rays. **Assessment:** Coursework 30%, Final Examination 70%	Assoc. Prof. Chow Wen Shyang 04-599 6160 shyang@eng.usm.my Dr. Zulkifli Mohamad Ariff 04-599 6173 zulariff@eng.usm.my

EBP 204 Elastomeric Materials	3	II	Viscoelastic concept and rubber elasticity. Raw rubber properties: plasticity, plastic retention index, and Mooney viscosity. Types of rubber: natural rubber, modified natural rubber, SBR, EPDM, IR, BR, CR, NBR, CSM etc. Properties and applications. Rubber curing and kinetic of vulcanization. Curemeter and curing characteristics: scorch and cure time. Crosslinks density: measured using Mooney-Rivlin and Flory-Rehner equations, effects on properties. Sulfur vulcanization: accelerator, activator and retarder functions. Reaction and mechanisms. Other types of vulcanization systems: peroxide, moisture, radiation etc. fillers and reinforcement. Types of filler, the effectiveness of reinforced theory, application and Guth-Smallwood equation, and effect of reinforced to properties. Vulcanizate testing and interpretation: stress-strain, hardness, tearing, compression set. Ageing, fatigue, creep, hyteresis etc. **Assessment:** Coursework 30%, Final Examination 70%	Dr. Azura A. Rashid 04-599 6111 azura@eng.usm.my Dr. Nadras Othman 04-599 6177 srnadras@eng.usm.my
EBP 207 Transport Phenomena in Polymers	2	II	Introduction to transport phenomena: Transport phenomena fundamentals and its importance in Polymer Engineering applications. General equations that are used in transport phenomena discussion such as Newton's law for viscosity, Fourier's law for heat transfer and Fick's law regarding diffusion process. Comparison between flow behaviour of non-Newtonian polymer fluid to that of Newtonian fluid. Discussion regarding problems of heat transfer in Polymer Engineering applications such as in melting / plasticization process in polymer processing procedures, product cooling process and its role in injection moulding, non-isothermal condition due to heat generation from viscous dissipation, etc. The role of mass transfer in Polymer Engineering applications and introduction to essential transport properties in polymer studies. **Assessment:** Coursework 30%, Final Examination 70%	Dr. Nadras Othman 04-599 6177 srnadras@eng.usm.my Dr. Zulkifli Mohamad Ariff 04-599 6173 zulariff@eng.usm.my
EBP 212 Latex Processing	3	II	Latex types, class and latex properties. Testing to determine properties of latex. To understand mechanism of film forming from latex and factors that controls the film properties. Ingredients for compounding, preparation, techniques to measure curing state and curing mechanism for latex compounds. To understand several techniques used to produce latex products, testing involved together with problem solving during production of latex products. To discuss problems with waste generate during latex processing and steps to minimize the problems. To explain allergy problems that exist because of latex compound ingredients, n-nitrosoamine generate that evaporate, and protein contents that can be absorbed in latex products. **Assessment:** Coursework 30%, Final Examination 70%	Dr. Azura A. Rashid 04-599 6111 azura@eng.usm.my Assoc. Prof. Chow Wen Shyang 04-599 6160 shyang@eng.usm.my
EBP 216 Polymer Engineering Laboratory	2	II	Contents of 11 experimental as follows: i. **Polystyrene emulsion polymerization:** Preparation of polystyrene sample using emulsion polymerization and investigate the effects of surfactant concentration on the rate of polymerization. ii. **Fenol-formaldehyde resin formation:** Investigate resin formation in acid or alkali conditions and to determine reaction progress based on formation of free formaldehyde and study the curing properties. iii. **Estimation of gel time and curing time for unsaturated polyester:** Investigation of curing reaction for commercial unsaturated polyester resin by observing effects of curing agents on the gel time and curing time. iv. **Stress-strain properties of polymeric materials:** Study the stress-strain behaviour for three different types of polymers. Effects of strain rate on tensile properties will also be observed. v. **Cold drawing and anisotropy of polymeric materials:** Isotropic properties will be introduce to sample with isotropic property using cold drawing. Anisotropy properties that exist will be studied. vi. **Annealing of polymeric materials:** Polymer samples will be roll using two roll mill and anisotropy conditions are introduced. Sample will be annealed at temperature below melting temperature and anisotropy properties will be studied. vii. **Flexural properties of polymeric materials:** To investigate flexure properties of polymeric materials by using cantilever beam. viii. **Creep properties of polymeric materials:** To investigate creep properties of polymeric materials. **Assessment:** Coursework 100%	Dr. Zulkifli Ahmad 04-599 6183 zulkifli@eng.usm.my

EBB 316 Corrosion and Degradation	3	II	Definition of corrosion and degradation. Its importance and cost of corrosion. Types of corrosion. Basic thermodynamics of corrosion cells. Pourbaix diagram. Kinetics and corrosion rate. Single electrode system. Polarization. Double electrode system. Localized corrosion. Interactions between corrosion and mechanical force. Corrosion protection and prevention - coating, electrochemical, inhibitors, materials selection and design. Degradation of polymeric materials, cements and concrete, glass. High temperature oxidation. **Assessment:** Coursework 40%, Final Examination 60%	Dr. Ahmad Azmin Mohamad 04-599 6118 azmin@eng.usm.my Dr. Shah Rizal Kasim 04-599 6172 srshahrizal@eng.usm.my
EBB 317 Materials Processing Laboratory	2	II	Various materials processing techniques • Slip casting • Making of plaster of Paris mould • Extrusion, jolly & jigger • Powder pressing & powder metallurgy • Glazing and decoration • Making of CO_2 sand mould & metal casting • Weldability • Cathodic Protection for buried steel • Film blowing and pultrusion machine • Construction of microelectronic circuit and properties of diod junctions **Assessment:** Coursework 100%	Dr. Julie Juliewatty Mohamed 04-599 5266 srjuliewatty@eng.usm.my
EBB 323 Semiconductor Fabrication Technology	3	I	Introduction to the history of microelectronic industry. Substrate Preparation Defect and purification of Si - methods in single crystal growth - Bridgman, Czochralski and floating techniques, wafer preparation or substrate - diameter sizing, orientation etc. Fabrication Technology Thin film growth - Epitaxial growth. Vapor phase epitaxy. Liquid phase epitaxy. Molecular beam epitaxy. Ion implantation. Implantation range. Effect on target structure. Channeling. Sputtering. Glow discharge spottering. Thermal oxidation. Oxide and nitrate masks. Mathematics of oxidation. Characterization of doped layers. Junction depth measurements. pnp Doping profiles. Photolithography Surface preparation, pattern production, mask alignment, etc. Other ideas on lithography - X-rays, electron beam, etc. metallization, interconnect. Photoresist process. Semiconductors assembly and packaging, quality techniques and reliability. Amorphous Semiconductor Behavior of electrons in amorphous solids. Density of states. Energy structure and sharp mobility edge. Mechanism of electronic conductivity. Hydrogenation and doping of amorphous silicon semiconductors. Preparation methods for amorphous semiconductor films. Organic semiconductor Bonding and behavior of electrons in molecule crystals. Biphenyi and polyacene systems. Conductivity mechanisms. Molecular structure effect and molecule mass. Applications of organic semiconductors. **Assessment:** Coursework 40%, Final Examination 60%	Assoc. Prof. Ir. Cheong Kuan Yew 04-599 5259 cheong@eng.usm.my Dr. Khairunisak Abdul Razak 04-599 6126 khairunisak@eng.usm.my Assoc. Prof. Sabar Derita Hutagalung 04-599 6171 mrsabar@eng.usm.my
EBB 325 Microscopy Laboratory	2	I	Practical class involves study of microstructure of engineering materials. • Preparation and examination of metallic specimens - etching of steels and alloys. • Quantitative metallographic - software application. • Application of SEM and modern metallurgical microscope. • Microstructure analysis on ceramic, polymer and composite materials. **Assessment:** Coursework 100%	Dr. Ahmad Azmin Mohamad 04-599 6118 azmin@eng.usm.my

EBB 332 Whitewares and Glasses	4	I	Glasses. Introduction glasses and history, properties of glass. Classification of various types of glasses. Body Compositions-raw materials, glass forming techniques, annealing process. Melting, refining and homogenizing. Forming methods for sheet glass, container glass and other forms. Annealing. Properties of Finished Glass Products - chemical, thermal, optical, mechanical and physical. Glass melting furnaces. The Malaysian Glass Industry in Perspective. Type of glasses - silicate glass, sheet, container and plate - Na_2O-CaO-SiO_2, K_2O-PbO-SiO_2, Na_2O-B_2O_3-SiO_2 glass systems, coloured glass, optical glass, fibre glass etc. Glass-ceramic - control principal, recrystalization, various type of technical glass and its applications. Whitewares. Classification of whitewares and other pottery products. Body Materials - typical compositions. Design of whiteware body systems. Physical Properties of Mixtures and Uniformity Concept. The Role of Water - Slip Casting, Moulds. Plastic Forming - extrusion, pressing, jolly-jigger, throwing. Semi-Dry Powder Pressing - tiles and flatware products. Drying and firing. Drying mechanisms and effect of heat to the body, vitrification and microstructural changes. Firing practice and firing schedule, product arrangement and setting. Various type of kiln, kiln furniture, product defects after drying and firing. Glazes. Decoration. Properties of Finished Ware - Mechanical, thermal and electrical. Whiteware Products in use. Malaysian Whiteware Industry. **Assessment:** Coursework 40%, Final Examination 60%	Prof. Ahmad Fauzi Mohd. Noor 04-599 6100 afauzi@eng.usm.my Prof. Radzali Othman 04-599 6122 radzali@eng.usm.my Assoc. Prof. Sabar Derita Hutagalung 04-599 6171 mrsabar@eng.usm.my
EBB 333 Transport Processes	3	I	Momentum transportation: Hydrostatic: moving fluids, types of flows, mass conservation, energy and momentum, measurement of pressure and velocity, losses in flows, viscosity, boundary layer theory. Dimension analysis and similarity. Heat transfer; Heat conduction in cylinders and spheres, heat transfer constant; heat transfer through convection, natural and forced convection; thermal radiation; heat transfer. Mass transportation: Diffusion in solid, Fick's Law, Diffusion in steady and nonsteady state, short circuit diffusion, diffusion in fluid. **Assessment:** Coursework 40%, Final Examination 60%	Dr. Ahmad Azmin Mohamad 04-599 6118 azmin@eng.usm.my Dr. Julie Juliewatty Mohamed 04-599 5266 srjuliewatty@eng.usm.my Assoc. Prof. Sabar Derita Hutagalung 04-599 6171 mrsabar@eng.usm.my
EBB 334 Mechanical Metallurgy	4	I	Elastic Behavior: plane stress, Mohr circle, tensor stress, stress intensity. Theory of elasticity: True stress and true strain, criteria of yield. Stress combination test. Relationship of plastic stress-strain. Slip line theory. Principle of upper limit theory Mechanical working of metal: Survey of processes Mechanic of metal working Effect heat on strain rate of stress flow Metallurgical structure Frictions and lubricants Residual stress Mechanical Testing of metal tension, target, hardness, fatigues, creep impacts. **Assessment:** Coursework 40%, Final Examination 60%	Dr. Shah Rizal Kasim 04-599 6172 srshahrizal@eng.usm.my Dr. Zuhailawati Hussain 04-599 5258 zuhaila@eng.usm.my

Course	Unit	Sem	Description	Lecturer
EBB 337 Advanced Material and Composites	3	II	Introduction to the advances materials development and its applications. • Ceramic engineering materials for heat engine application, electronic, automotive, biomaterials, biomedical etc. • Advanced processing for ceramic. • Alloys and super alloys development based on Ti, Ni, Al-Li etc. • Manufacturing and application. Intermetallic materials. • Composite materials, - various type of composites (MMC, CMC & PMC). The importance of matrix and reinforcement materials. • Failure mechanism, application and composite design. **Assessment:** Coursework 40%, Final Examination 60%	Assoc. Prof. Mariatti Jaafar 04-599 5262 mariatti@eng.usm.my Dr. Zuhailawati Hussain 04-599 5258 zuhaila@eng.usm.my Dr. Ahmad Azmin Mohamad 04-599 6118 azmin@eng.usm.my
EBB 338 Process Control	3	II	This course the structure of feedback control theory from the basic mathematics to a variety of design applications. The design of an over-all process control system requires a good theoretical understanding of stability, the dynamic characteristics of controllers and general process-control loop dynamic characteristics. The course discusses terminology, concepts, principles, procedures and computations used in the design activity to select, analyze, specify and maintain all parts of the control system. **Assessment:** Coursework 40%, Final Examination 60%	Assoc. Prof. Sabar Derita Hutagalung 04-599 6171 mrsabar@eng.usm.my Dr. Julie Juliewatty Mohamed 04-599 5266 srjuliewatty@eng.usm.my Dr. Zainovia Lockman 04-599 6178 zainovia@eng.usm.my
EBB 342 Control and Management Quality	3	II	This course presents knowledge and demonstrates skills necessary to structure, manage, maintain, and improve quality of an organization. Topics include: Introduction to quality, management aspects of quality, statistical methods to control and improve quality, and concept of reliability. **Assessment:** Coursework 40%, Final Examination 60%	Assoc. Prof. Ir. Cheong Kuan Yew 04-599 5259 cheong@eng.usm.my Assoc. Prof. Sabar Derita Hutagalung 04-599 6171 mrsabar@eng.usm.my
EBB 350 Industrial Training	5	I & II	A ten weeks industrial training during long vacation i.e. after the second semester final examination (third year level). Students will get their placement at various industrial sectors related to materials engineering. They should experience the real exposure as an engineer in this field. Students will be given training on various aspects such as analysis, design, management, quality control and economy, which related to their career as a materials engineer. This is a compulsory training. **Assessment:** Coursework 100%	Assoc. Prof. Mariatti Jaafar 04-599 5262 mariatti@eng.usm.my

EBB 398 Occupational Safety and Health	3	I	To introduce the need of safety and health at workplace required by existing law and its importance for the development of industry. Introduction to Malaysian Law related to safety and health at workplace - Safety and Health at Workplace Act, Factory and Machinery Act, and rules derived from the above acts. National Board for safety and health at workplace. Employer general responsibility and self-employed workers. Designers, manufacturers and suppliers general responsibilities. Workers general responsibility. Safety and health organization. Notice on accident, dangerous accident, worker poisoning, worker diseases and detection. Direction not to use plants or materials. Industrial code of practice. Responsibility under the Civil Law Act. Practices and case study from outside Malaysia. **Assessment:** Coursework 40%, Final Examination 60%	Prof. Dato' Ir. Eric Goh 04-599 6112 eric@eng.usm.my
EBS 308 Materials Transport Engineering	3	II	Belts conveyor; chain conveyor; bucket elevator; screw conveyor. Fluid transport: hydraulic system; pneumatic system. Rope haulage; types of wire ropes. Locomotive transport; types of locomotives; Hoisting systems; balanced and unbalanced; friction wheel and friction winder; balanced skip hoist. **Assessment:** Coursework 40%, Final Examination 60%	Assoc. Prof. Hashim Hussin 04-599 6114 hashim@eng.usm.my Dr. Zaimawati Zainol 04-599 6125 srzaima@eng.usm.my

EBS 311 Mining Methods and Law	3	I	**Surface Mining Methods** **Introduction** An insight to the economy and general factors for the application of surface mining method, stripping ratio and its relationship to grade and market price. **Mining Method** Classification of mining methods and the characteristics of the ores for the application of each method. Development of each method, advantages and disadvantages of each method. Understanding the process involve in the production aggregate in quarrying for road construction and the environmental aspect for the tailings or rock waste. **Mine Stability** Discussion on how the information in soil mechanics and rock mechanics can assist in the planning of the surface mines. Basic understanding of the monitoring devices and the controlling methods for the stability of the working areas. **Underground Mining Methods** **Shaft sinking and ramp development** The principles in sinking a shaft, types of shaft and their relationship to the occurrence of the orebody. Ramp in underground development and its advantages as oppose to vertical shaft. **Excavation, stopes and equipment** Underground development such haulageways, orepasses, underground ore bin, underground pumping station and others. Mining equipments for the underground excavation, stoping, transportation or ores (drilling machines, track mounted vehicles, dump trucks, LHDs and others). Filling of the stopes. Usage of computer system in monitoring and control of underground operation. Drainage of underground mines. **Mining Laws** Introduction to mining laws and other laws related to mining as follows: Mining Enactment Cap. 147 Mineral Development Act 1994 State Mineral Enactment. Explosive Act 1978 Explosive Rules 1923 Environmental Quality Act 1974 Perak Quarry Rules 1992 Factories and Machinery Act, 1967 Occupational Safety and Health Act, 1994. **Assessment:** Coursework 40%, Final Examination 60%	Dr. Syed Fuad Saiyid Hashim 04-599 6181 mrsyfuad@eng.usm.my
EBS 315 Hydrometallurgy	3	I	Hydrometallurgy. Eh-pH diagrams. Methods of leaching. Kinetics of leaching processes. Application to important cases like copper, gold, aluminium etc. Recovery from dilutes solutions. Purification and recovery of metal values from pregnant solution, solvent extraction, ion exchange, CIP, hydrogen reduction, precipitation methods. Electro-metallurgy. Basic aspects of Electro-winning and Electro-refining. Types of cells. Application to aqueous electrometallurgy of metals. **Assessment:** Coursework 40%, Final Examination 60%	Dr. Norlia Baharun 04-599 6121 norlia@eng.usm.my Dr. Zaimawati Zainol 04-599 6125 srzaima@eng.usm.my
EBS 322 Physical Mineral Processing	3	I	Heavy media separation. Heavy liquid testing. Separation Curves. Efficiency evaluation and design. Flotation. Fundamental principles. Collectors, frothers & modifiers. Flotation cells. Flotation circuits. Physical and chemical factors affecting recovery & grade performance. Applications of flotation to sulphide & non-sulphide ores. Electrostatic and magnetic separation methods. Low and high intensity magnetic separators, wet and dry. Principles of high-tension separation. Applications in the treatment of alluvial tin deposit ilmenite etc. Electronic separation. Its uses in diamond separation. Radiometric sorting. Dewatering and techniques used. Sedimentation, thickening, filtration and drying techniques. Tailings disposal. Types of tailing dam and their construction. Methods of controlling pollution and water reclamation. **Assessment:** Coursework 40%, Final Examination 60%	Assoc. Prof. Hashim Hussin 04-599 6114 hashim@eng.usm.my

EBS 323 Pyrometallurgy	3	II	The principles of metals extraction at high temperatures, thermodynamic principles. Principles and practices of blast furnace iron making, Physicochemical transformations inside the blast furnace, Various gas-slag-metal reactions at high temperature, Effects of important process parameters on furnace performance, Principles and practices of Direct Reduction Iron-making (DRI): HyL & MIDREX processes, Principles of smelting reduction processes, Outline of COREX, HiSmelt Principles of steelmaking, Thermodynamic principles involved, Slag chemistry and slag models, Removal of elements, Desulphurization, Dephosphorization, Various steelmaking processes – Open hearth, BOF, EAF. Principles of refining of steel, De-gassing processes, De-oxidation processes, Concept of "clean steel", ladle metallurgy, Continuous casting Principles of oxidation-reduction reaction in non-ferrous metals extraction. Roasting processes: Drying and calcining, Agglomerating processes Matte smelting: Smelting, Converting, Continuous processes Vapour metallurgy: Vapour phase separation, Metal-vapour & metal-gas processes Refining: Liquation, Compound formation, Vacuum refining. **Assessment:** Coursework 40%, Final Examination 60%	Dr. Projjal Basu 04-599 5261 projjal@eng.usm.my
EBS 325 Mineral Chemistry Laboratory	2	I	Mineral analysis laboratory is a practical exercise on the analysis of ores, rocks and geological samples. Conventional methods such as titration's, gravimetry, and fire assay as well as instrumental methods such as AAS, UV-Viz., XRF and XRD will be employed. Various digestion methods using various acids and acids combination (req. aqua regia) will also be used for sample dissolution. **Assessment:** Coursework 100%	Dr. Norlia Baharun 04-599 6121 norlia@eng.usm.my
EBS 328 Prospecting Geochemistry	3	II	Types of geochemical survey: soil, stream sediment, hydrogeochemistry, heavy minerals, lithogeochemistry, and biogeochemical. Environment. Primary versus secondary. Dispersion patterns (primary and secondary), pathfinder elements, path indicator elements. The role of chemical and physical weathering. The role of pH, Eh, adsorption, mobility on dispersion patterns. Basic principles: contamination, orientation surveys, anomalies, false anomalies, reconnaissance survey, regional and detailed surveys. Sampling, sampling media, magnitude of sampling. Statistical treatment of geochemical data - simple statistics, lognormal statistics, geostatistics. The application of statistical interpretation to geochemical survey. Students are required to do field work employing the techniques that they've learned from the course work. They will do sampling, analyze the samples and interpret the geochemical data. Case studies will be used as guides to the usefulness of geochemistry in mineral exploration. **Assessment:** Coursework 40%, Final Examination 60%	Tuan Besar Tuan Sarif 04-599 6158 tuan@eng.usm.my
EBS 329 Engineering Geophysics	3	II	Introduction to the exploration geophysics. Application of seismic surveying in geology, engineering and exploration. Elastic properties of rocks, seismic waves, propagation of seismic waves, Reflection and refraction of seismic waves. Gravity surveying and its application in exploration. Earth's gravity, gravity anomalies, gravity measurements and reductions. Magnetic surveying and its applications in exploration, earth's magnetic field, magnetic anomalies, electromagnetism and ferromagnetism. Electrical surveying and its application in exploration, flow of current through soil and rocks, resistivity, induced potential, and self-potential. **Assessment:** Coursework 40%, Final Examination 60%	Dr. Hareyani Zabidi 04-599 6124 srhareyani.zabidi@ eng.usm.my

EBS 336 Analytical Chemistry	3	I	This is an introductory course to analytical chemistry and will cover major areas of conventional and modern instrumental analytical techniques. It is divided into three major sections. Section A: Concepts in analytical chemistry - will review fundamental concepts such as moles and concentrations of solutions, various types of analysis, importance of statistics in analytical chemistry and sampling. Section B will touch on the classical methods such as titrations, gravimetry and separations (e.g. solvent extraction). Instrumental techniques in section C will include UV- VIZ spectrometry, Atomic absorption spectrometry and x-ray Fluorescence spectrometry. Examples and emphasis will be given to geological, ore and mineral samples. **Assessment:** Coursework 40%, Final Examination 60%	Dr. Norlia Baharun 04-599 6121 norlia@eng.usm.my
EBS 339 Mineral Economics	3	II	Methods of investment analysis for mining projects: Comparison of investment alternatives. Financial considerations of investment appraisal. Cash-flow analysis. Evaluation of mining enterprises. Economic evaluation of mineral deposits. Optimal reserve selection. Incorporation of marketing into mine evaluation. Maintenance management, materials management, compensation management. Labor standard costing. **Assessment:** Coursework 40%, Final Examination 60%	Prof. Dato' Ir. Eric Goh 04-599 6112 eric@eng.usm.my Dr. Syed Fuad Saiyid Hashim 04-599 6181 mrsyfuad@eng.usm.my
EBS 341 Mineral Processing Laboratory	2	II	Students will conduct practical relating to the operations and in determining the performance and efficiency of equipments in the mineral-processing laboratory. **Physical processing** Comminution: Crushing and screening, fine grinding and classification methods. Mineral concentration methods: Gravity, flotation, magnetic and high-tension separation. Chemical Processing Leaching: Introduction to several techniques of leaching e.g. Solvent extraction: for refining pregnant solution from the solvent extraction step. Electrowining and Electrorefining processes to recover valuable metal from solution. **Assessment:** Coursework 100%	Dr. Zaimawati Zainol 04-599 6125 srzaima@eng.usm.my
EBS 350 Industrial Training	5	I & II	A ten weeks industrial training during long vacation i.e. after the second semester final examination (third year level). Students will get their placement at various industrial sectors related to mineral resources engineering. They should experience the real exposure as an engineer in this field. Students will be given training on various aspects such as analysis, design, management, quality control and economy, which related to their career as a materials engineer. This is a compulsory training. **Assessment:** Coursework 100%	Dr. Syed Fuad Saiyid Hashim 04-599 6181 mrsyfuad@eng.usm.my

EBP 303 Plastic Materials	3	I	Plastic database: definition and classification, type/technique (classic and internet), characterization/advantages and vice versa, aims for typical Internet database. Plastic material: definition and classification; structure/property/application relationship; general behavior both thermoplastic and thermoset; emphasis on selected plastic materials (commodity e.g. PE, PP, PS, PMMA, engineering e.g. ABS, PC, Nylon, specialty plastics e.g. ionomer, LCP, Floropolymer), thermoset e.g. unsaturated Polyester and epoxy. Plastic compounding and additives: Definition and classification; compounding principal and additives function; testing and optimization in compounding; focus on selective additive e.g. filler and reinforcement, plasticizer, lubricant, flame retardant, etc: DMC and BMC concept in thermoset base system; master batch and predispersing chemical ingredients in compounding process**.** Material selection: definition and purpose**;** individual and combination approach; material selection with help of computer e.g. PLASCAM, CAMPUS etc. selection case study. Plastic recycle resources and types of plastic scrap, other scrap characteristics; criteria and recycle conditions. **Assessment:** Coursework 40%, Final Examination 60%	Prof. Zainal Arifin Mohd. Ishak 04-599 6182 zarifin@eng.usm.my Assoc. Prof. Azhar Abu Bakar 04-599 6102 azhar@eng.usm.my Dr. Razaina Mat Taib 04-599 6123 razaina@eng.usm.my
EBP 306 Properties of Polymer Materials Engineering	3	I	Stress-strain relationship: stress-strain definition, stress-strain curve, temperature and effect of strain rates. Rubber elasticity: network, thermodynamic and rubber elasticity, statistical theory of rubber elasticity, elasticity network, stress-strain behavior, network defects, phenomenological theory. Deformation and yield behavior- necking and crazing failure, molecular model rubber reinforced plastic**.** Linear vicoelastic; stress relaxation, Boltzmann superposition principal, creep test, time-temperature superposition conditions, relaxation behavior. Polymer cracking: ductile-brittle change, strength theory, Griffith theory, visco-elastic, mechanical failure, fatigue and environmental stress cracking**.** Testing: specification and sampling standard procedure, testing techniques. **Assessment:** Coursework 40%, Final Examination 60%	Prof. Zainal Arifin Mohd Ishak 04-599 6182 zarifin@eng.usm.my Dr. Nadras Othman 04-599 6177 srnadras@eng.usm.my Dr. Razaina Mat Taib 04-599 6123 razaina@eng.usm.my
EBP 307 Polymer Rheology	2	II	Polymer materials foundation: general behavior, viscous-elastic and their relationship with polymer processing. Polymer processing: General behavior and relationship with flow or deformation; effects of polymeric factors, processing factors and mould factor towards flow in actual processing such as injection and compression molding. Polymer rheology foundations: definition and classification; rheology behavior towards shear and elongation flow type e.g. Newtonian, Troutonian, pseudo-plastic, dilatants etc; zero-shear region; Power laws; flow implication or actual processing behavior; materials effect, pressure, temperature towards rheology. Rheology measurements; types of rheometer such as constant stress or constant rate; capillary; co-axis; parallel plate; rheometer torque; MFI and coil flow index. **Assessment:** Coursework 40%, Final Examination 60%	Dr. Razaina Mat Taib 04-599 6123 razaina@eng.usm.my Dr. Zulkifli Mohamad Ariff 04-599 6173 zulariff@eng.usm.my
EBP 308 Rubber: Processing and Product	3	I	Rubber processing - compounding techniques, molding and vulcanization. Preparation, vulcanization and properties of synthetic rubbers: butadiene, styrene butadiene, butyl, nitrile, ethylene propylene**,** thermoplastic elastomer, silicone etc. Rubber products manufacture such as tire, shoes, hose, household and engineering product. Rubber compounds - compounding principal, factors that effecting compounds, the used of compatible agent in compounds, co-vulcanization agents and co-vulcanization behavior and several examples of compound products. Rubber-plastic or thermoplastic elastomer compounds - principal and aim, criteria for compounding, chemical/physics or mixed compounds, rubber reinforced plastic, dynamic vulcanization and several examples of TPE. Rubber recycling - environmental consideration, the need for recycling, latex products such as gloves, dry rubber products such as tire etc. Research innovation- new rubbers, novel vulcanization and rubber reinforcement, rubber compounds and TPE with current recycling techniques. **Assessment:** Coursework 40%, Final Examination 60%	Prof. Hanafi Ismail 04-599 6103 hanafi@eng.usm.my

EBP 310 Plastic Processing	3	I	To understand terms used to describe processing techniques for plastic products. To understand techniques for plastic products production such as extrusion, blow molding, injection molding and so forth including factors that control quality of plastic products. **Assessment:** Coursework 40%, Final Examination 60%	Assoc. Prof. Azhar Abu Bakar 04-599 6102 azhar@eng.usm.my Dr. Nadras Othman 04-599 6177 srnadras@eng.usm.my
EBP 314 Resin Manufacturing	3	II	Plant design: Introduction to plant design, development process of plant design, general considerations for designing, material selection and fabrication. Manufacturing, compounding, processing, characteristics and application for (1) thermoset resins such as alkyd, phenolic, aminoplast, polyester, epoxy, polyurethane, and silicone; (2) commercial and engineering thermoplastic resins such as polyolefin, vinyl, polystyrene and copolymer, polyamide, synthetic rubber; (3) specialty polymeric resins and heat resistance types such as polyimide, polybenzimidazole, LCP and others. **Assessment:** Coursework 40%, Final Examination 60%	Assoc. Prof. Azlan Arifin 04-599 6176 azlan@eng.usm.my
EBP 316 Latex Laboratory	2	II	The scope of this course covers basic test methods to determine latex quality (chemical composition, colloid stability, and physical properties), preparation of latex compound, manufacturing of products from latex using dipping and foaming methods and test methods to determine mechanical properties of latex products. Testing is according to ISO standard Experiments that will be carried out are as follows: i. Determination of total solid contents (TSC) and dry rubber content (DRC) of NR latex: To determine the TSC and DRC of NR latex according to ISO standard. ii. Measurement of mechanical stability time (MST) and viscosity of NR latex: To measure the effects of temperature and viscosity to MST value of NR latex. iii. Measurement of alkalinity of NR latex: To measure the effects of anionic and cationic stabilizer on alkalinity value of NR latex. iv. Measurement of potassium hydroxide number (KOH number) of NR latex: To measure the effects of alkalinity value and TSC changes on KOH number of NR latex. v. Measurement of volatile fatty acid number (VFA number) of NR latex: To measure the effects of acid acetic as acid sulfuric replacements on VFA number of NR latex. vi. Investigation on the effect of pre-vulcanization time on the tensile properties of NR latex films: To investigate the effects of pre-vulcanization time on tensile properties of NR films using the chosen formulation and the dispersion that has been prepared using ball mill. The films will be prepared using dry coagulant dipping. vii. Study the effect of fillers on the viscosity, optimum pre-vulcanization time and tensile properties of NR latex films: To investigate the effects of colloidal silica additions on the chosen formulation on viscosity, optimum pre-vulcanization time and tensile properties on resultant NR latex films. viii. Study the effect of leaching on the tensile properties of NR films: To investigate the effects of different leaching parameters on tensile properties NR films based on the formulation chosen using dry coagulant dipping. **Assessment:** Coursework 100%	Dr. Azura A. Rashid 04-599 6111 azura@eng.usm.my

EBP 317 Advanced Polymer Composites	3	II	Composites material: history and classification, polymer composites. Polymer matrix: types of matrix, selection criteria. Inter-phase: bonding mechanisms, inter-phase treatment. Fabrication techniques: Type of fabrication techniques, selection criteria. Composites mechanic: stiffness, strength and elasticity for fiber reinforced composites. Environmental effects: moisture effect, solvent and chemical effect, thermal and thermo-oxidative. Testing and quality assurance: destructive and non-destructive testing, quality assurance. Design protocol and product development. **Assessment:** Coursework 40%, Final Examination 60%	Prof. Zainal Arifin Mohd. Ishak 04-599 6182 zarifin@eng.usm.my Dr. Razaina Mat Taib 04-599 6123 razaina@eng.usm.my
EBP 320 Rubber Laboratory	2	I	Involves compounding, processing, and testing of rubber vulcanizates that used sulfur as the accelerator, rubber such as NR, SBR, and EPDM and silica and carbon black as fillers. With regards to processing and testing, there are 7 experiments as follows: **i. Viscosity and plasticity measurements for Rubber** To measure Mooney viscosity and to follow the reduction in molecular weight of natural rubber by measuring plasticity after mastication. **ii. Mixing and compounding** To prepare rubber compound using two roll mill and evaluate the functions of various additives used. **iii. Curing** To understand the use of rheometer and to evaluate and derive from the rheographs various results concerning curing such as scorch time, optimum curing, reversion, and curing rate. **iv. Rubber vulcanization** To use compression molding for vulcanization process and to prepare test pieces for physical testing. **v. Tensile and tearing tests** To determine elastic properties of several rubber vulcanizates using tensometer. **vi. Hardness, resilience, and abrasion test** To carry out hardness, resilience, and abrasion tests for vulcanized rubber samples with regard to BS/ASTM methods. **vii. Rubber aging** To follow oxidative and thermal degradation of several rubber vulcanizates. **viii. Determination of cross-linking density** To determine cross-linking density of a rubber vulcanisate using swelling method by means of Flory-Rehner equation. **xi. Effect of natural and synthetic rubbers on hardness and tensile properties** To investigate the effect of crystallization on hardness and tensile properties of natural and synthetic rubbers. **x. Effect of fillers on hardness, resilience and abrasion** To investigates effect of different fillers on hardness, resilience, and abrasion properties of rubber samples with regard to BS/ASTM methods. **Assessment:** Coursework 100%	Dr. Nadras Othman 04-599 6177 srnadras@eng.usm.my
EBP 324 Polymer Degradation and Environment	3	II	Thermal, oxidative, photo-degradation, chemical and hydrolytic stability, effect of radiation, mechanodegradation, and weathering of polymers. Methods to evaluate degradation. Polymer stabilisers; antioxidants, UV stabilizer, metal deactivator, and thermal stabilizer. Biodegradation; control of biodegradation, methods to evaluate biodegradation, natural biodegradation of polymer, synthetic biodegradation of polymer. Polymer management within the environment; recycling, recyling through devulcanization and incineration. **Assessment:** Coursework 40% Final Examination 60%	Prof. Hanafi Ismail 04-599 6103 hanafi@eng.usm.my Assoc. Prof. Chow Wen Shyang 04-599 6160 shyang@eng.usm.my

EBP 350 Industrial Training	5	I & II	Students will get their placement at various industrial sectors related to polymer engineering. A ten weeks industrial training during long vacation i.e. after the second semester final examination (third year level). They should experience the real exposure as an engineer in this field. Students will be given training on various aspects such as analysis, design, management, quality control and economy, which related to their career as a materials engineer. This is a compulsory training. **Assessment:** Coursework 100%	Dr. Zulkifli Mohamad Ariff 04-599 6173 zulariff@eng.usm.my
EBB 405 Failure Analysis and Non Destructive Testing	3	I	The study of defects that appears when metals, ceramic and polymer are processed. Characterization and detection methods. The shapes of several fracture modes are discussed. Method of failure investigation during services and examples are given for investigation. Type of defects. Overview of Non Destructive techniques. Confirmation of crack near surface, liquid penetrant diffusion, Magnetic crack detection (Magnaflux, Magnoglo), Electrostatic crack detection, Eddy current method. Radiography. Radiation selection, Application of gamma and neutron radiation. Transducer, acoustic resistance, attenuation, resolution. Evaluations of finish surface appearance. Thickness measurement. Capacitance's method, inductance and resistance. Application of radiation and ultrasonic. Shape measurement. Online and Offline methods. Automatic procedure for testing and 'on line' control. **Assessment:** Coursework 40%, Final Examination 60%	Assoc. Prof. Mariatti Jaafar 04-599 5262 mariatti@eng.usm.my Dr. Ahmad Azmin Mohamad 04-599 6118 azmin@eng.usm.my Mr. Ahmad Badri Ismail 04-599 6107 badri@eng.usm.my
EBB 407 Final Research Project Materials	6	II	Individual/group research project on selected topic in Materials Engineering. Research include literature survey, analysis of previous work, research experimental design and experimental set up. Executing experimental work, collecting data, discussion, dissertation writing and oral presentation. **Assessment:** Coursework 100%	Assoc. Prof. Mariatti Jaafar 04-599 5262 mariatti@eng.usm.my
EBB 408 Materials Selection Design	3	II	Introduction to the materials selection process. Selection based on economy, classification of engineering materials (metals, polymers, ceramics and composites). Engineering Materials and Their Properties: modulus, strength, hardness, toughness, fatigue, creep, corrosion, and wear. Material selection requirements (service, economy and fabrication). The Design Process - introduction, factors that influenced design, design code of practice, design consideration probability, design characteristics (function, shape, fabrication technique, cost). Philosophy in design - comparison based on cost and properties of materials. Use of AutoCAD in Engineering Design. Price and Availability. Materials Selection Charts. Materials Selection without Shape plus Case Studies. Selection of Materials and Shape plus Case Studies. Materials Processing and Design, Case Studies on Process Selection. Sources of Material Property Data. Case Studies on Use of Material Data Sources. Materials, Aesthetics and Industrial Design. Forces for Change. **Assessment:** Coursework 40%, Final Examination 60%	Prof. Radzali Othman 04-599 6122 radzali@eng.usm.my Dr. Nurulakmal Mohd. Sharif 04-599 6180 nurul@eng.usm.my

EBB 409 Fluid Power and Turbo Machinery	3	II	Fluid power - Hydraulic system and pneumatic - application of hydraulic fluid-basic components for hydraulic system - transmission and hydraulic system control - maintenance - hydraulic circuit design. Turbo machine - Introduction - power absorption vs. power supply machine, classification of turbo machine, turbo machine equation - Euler's equation, power and efficiency - construction - hydraulic turbine -impulse and reaction - pelton wheel, Francis turbine, Kaplan turbine. Pumps, classification - centrifugal pump and equiaxed pump, out put, efficiency - cavitation efficiency characteristics of turbines and hydraulic pump. **Assessment:** Coursework 40%, Final Examination 60%	Dr. Srimala Sreekantan 04-599 5255 srimala@eng.usm.my Dr. Yeoh Fei Yee 04-599 6175 srfeiyee@eng.usm.my
EBB 424 Semiconductor Devices and Optoelectronics	3	I	Dipolar junction transistor – dc, explanation, transistor behaviour, charge control model, BJT efficiency, BJT damage, Ebers-Moll model. Dipolar junction transistor – ac, IV characterization, small signal ac-hybrid-π model, h parameter, large ac signal, switching, real dipolar equipment – examples. Junction field effect transistor – basic principal, before and after the pinchoff, IV characterization, small signal ac models. Metal oxide field effect transistor – MOS capacitor, concentrator, reversal, etc. MOS transistor – explanation, various type, IV characterization. Basic principal on laser and semiconductor optoelectronic. **Assessment:** Coursework 40%, Final Examination 60%	Dr. Zainovia Lockman 04-599 6178 zainovia@eng.usm.my Assoc. Prof. Sabar Derita Hutagalung 04-599 6171 mrsabar@eng.usm.my
EBB 425 Research and Design Ceramic Materials	3	II	Introduction to ceramic design - Design consideration (cost, application requirements etc) and approaches (empirical, deterministic, probabilistic etc). One case study. Glaze and decoration. Glaze classification, defects and failure. Decoration techniques. Mould. Mould materials and its properties. Various types of moulds and its quality control. Fine ceramics. Local and foreign ceramic arts and cultural influence. Management of ceramic industries. Set up of a ceramic plant. Equipments and R & D department. **Assessment:** Coursework 40%, Final Examination 60%	Prof. Zainal Arifin Ahmad 04-599 6128 zainal@eng.usm.my Dr. Hasmaliza Mohamad 04-599 5263 hasmaliza@eng.usm.my Dr. Shah Rizal Kasim 04-599 6172 srshahrizal@eng.usm.my
EBB 427 Technology and Application of Engineering Polymer	3	I	Introduction to plastic technology: raw materials and preparation; Thermosets and Thermoplastics process of production and manufacturing/forming (compression, injection, extrusion, calendering, thermal fabrication and etc) properties and engineering applications. Properties of thermoset and thermoplastic – testing methods. Application of thermoset and thermoplastic. General and engineering applications New polymer materials for engineering applications – heat resistant polymer, wear resistant polymer, special applications, polycrystalline polymers, mechanical properties and design involves polymer and composite application. Introduction to elastomers and their engineering applications**.** Case study whereby polymer could substitutes conventional materials such as metal and ceramic. **Assessment:** Coursework 40%, Final Examination 60%	Prof. Madya Hazizan Md. Akil 04-599 6161 hazizan @eng.usm.my Assoc. Prof. Mariatti Jaafar 04-599 5262 mariatti@eng.usm.my

Course	Units	Sem	Synopsis	Lecturer
EBB 440 Applied Metallurgy	4	I	Introduction to metallurgical principle for manufacturing of metal components/products and to investigate the factors that influence the efficiencies of manufacturing and services. Castings Mechanical working of metals and alloy. Hot and cold working processes in forging, extrusion, rolling, wire and rod drawing stress flow in deformation. Requirement of forces and power in designing of dai and defects that occurs in bulk deformation process. Working processes of sheet metal. Powder metallurgy. Welding and other joining process (gas welding, arc welding, laser welding and electron beam). Machining processes: Principle and technique of metal discharged (turning, milling, bearing, matching, EDM, ECM and others). **Assessment:** Coursework 40%, Final Examination 60%	Dr. Nurulakmal Mohd. Sharif 04-599 6180 nurul@eng.usm.my Mr. Ahmad Badri Ismail 04-599 6107 badri@eng.usm.my
EBB 443 Technical Ceramics	4	I	Sintering; Sintering stages and their mechanism, function of sintering. Grain growth and grain growth inhibitor. Electroceramic Types of electroceramics (insulator, high frequency ceramics, piezoelectric, etc.), properties required and applications, manufacturing techniques. Advanced ceramics and ceramics for high temperature. Applications. Types of ceramics related to these applications (Al_2O_3, ZrO_2, Sialon, Si3N4 etc.). Studies on their strength and toughness, Weibull statistics. Refractories - classification of refractories and their usage in manufacturing industries, manufacturing of refractories and their important properties. **Assessment:** Coursework 40%, Final Examination 60%	Prof. Zainal Arifin Ahmad 04-599 6128 zainal@eng.usm.my Dr. Hasmaliza Mohamad 04-599 5263 hasmaliza@eng.usm.my Dr. Srimala Sreekantan 04-599 5255 srimala@eng.usm.my
EBS 417 Geomechanics	3	I	Soil Mechanics • Classification & 3 phase composition • Effective stress principle • Compressibility and settlement • Rigidity and strength in disturbance state. 5. Theory of limiting earth pressure (Rankine's) • Deformation and boundary conditions. Rock Mechanics • Deformability, strength and failure of intact rock. • Rock mass classification • Shear strength of discontinuities • Slope stability and rockfalls hazards in slopes. • Factor of safety and probability of failure • Tunneling and instability in tunnels • Rock support • In situ and induced stresses • Stereographic projection **Assessment:** Coursework 40%, Final Examination 60%	Dr. Hareyani Zabidi 04-599 6124 srhareyani.zabidi@eng.usm.my Dr. Samayamutthirian Palaniandy 04-599 6132 samaya@eng.usm.my
EBS 418 Petroleum Engineering	3	II	Origin and accumulation of petroleum. Exploration, estimation and valuation of petroleum reserves. Drilling operation, drilling fluid, abnormal pressure, well control and well completions. Petroleum production methods. **Assessment:** Coursework 40%, Final Examination 60%	Dr. Syed Fuad Saiyid Hashim 04-599 6181 mrsyfuad@eng.usm.my

EBS 419 Blasting Technology	2	II	• History of explosives. • Characteristics of Explosives – categories, chemical stability or self life, density, velocity of detonation, strength, sensitivity. • Types of explosives – nitroglycerine based explosives, ANFO, water gel and emulsion. • Blasting accessories – safety fuse & plain cap, detonating cord, shock tube, electric and electronic detonators. • Theory of blasting – nature of detonation, detonation and interaction with rock. • Effect of rock properties in blasting – structure and geology. • Firing characteristics of electric detonators and the electric circuits. • Extraneous electricity hazards – lightning, static electriciy, stray currents, electromagnetic induction. • Initiation of explosives – effect of detonating cord, primer, booster. • Blasting in surface excavation – blasthole pattern, initiation pattern, delay intervals, blast design, secondary blasting. • Underground mining and excavation – burnt cut, wedge cut, sequence of detonation, shaft sinking. • Controlled blasting – line drilling, presplitting, cushion blasting, perimeter blasting. • Environmental control. • Safe practice in blasting. **Assessment:** Coursework 40%, Final Examination 60%	Dr. Samayamutthirian Palaniandy 04-599 6132 samaya@eng.usm.my
EBS 423 Mine and Plant Design	4	I	Students are required to design a mine or quarry and plant associated with the mine or quarry from a given data. The design will include the valuation of the data and the feasibility studies of a proposed mine or quarry. **Assessment:** Coursework 100%	Dr. Syed Fuad Saiyid Hashim 04-599 6181 mrsyfuad@eng.usm.my
EBS 425 Industrial Minerals	3	I	Introduction to the occurrence of industrial minerals and its importance to the industry. To understand and to identify the minerals suitable for the industries. **Assessment:** Coursework 40%, Final Examination 60%	Assoc. Prof. Hashim Hussin 04-599 6114 hashim@eng.usm.my Dr. Kamar Shah Arifin 04-599 6116 kamarsha@eng.usm.my
EBS 429 Environmental Engineering	3	I	Environmental pollution; level and movement of pollutants; effects of pollution; awareness of pollution from various technology. Additional resident waste. Environmental laws. Air pollution; weather and climatic aspects; industrial waste; exhausts products of the car engines. Sources and dissipation of industrial and commercial waste gas. Sources and removal of waste water from industries. Inter-connected pollution and control. Close-circuit processes in the industry and agriculture. Thermal pollution. Radiation. Waste disposal. Instrumentation and monitoring. Uses of natural geology with the aim of solving environmental problems. Land resource planning: liquid waste disposal, mining; foundation, structure, geological hazard, mineral resources and energy. **Assessment:** Coursework 40%, Final Examination 60%	Prof. Dato' Ir. Eric Goh 04-599 6112 eric@eng.usm.my
EBS 430 Final Year Research Project	6	II	Each student will be given a research title and he or she will be required to conduct whatever investigation or research in connection to the title. At the end of the semester each student will have to make an oral presentation and a report or dissertation. **Assessment:** Coursework 100%	Dr. Syed Fuad Saiyid Hashim 04-599 6181 mrsyfuad@eng.usm.my

EBS 432 Environmental Chemistry for Engineering Practice	3	II	This course introduces the basic concept of chemistry and analytical knowledge and the fundamental chemical principles of different processes adopted by environmental engineering. It is designed to assist the engineering students and environmental practitioners in understanding how the chemical applications fit their daily needs in environmental chemistry. The syllabus text will cover a review of basic chemistry topics that are relevant to environmental engineering. These topics include physical chemistry, organic chemistry, analytical chemistry (including instrumental methods) and colloid and surface chemistry followed by brief discussions on the major cycles (atmosphere, hydrosphere and pedosphere) and their inter-relationships. The next section deals with processes involving chemical equilibrium, followed by chemical processes, and the physiochemical processes used in the treatment of industrial waste. **Assessment:** Coursework 40%, Final Examination 60%	Dr. Norlia Baharun 04-599 6121 norlia@eng.usm.my
EBP 400 Product Design and Failure Analysis	3	I	Product design: definition and product design concepts; stress-strain behavior and analysis of stress in polymer; design of fundamental geometry structure or structure design such as beam, plate and others; design of structure for stiffness and processing limits and their effect during application and on the environment. Design procedures for product application of interests (mechanical or load bearing, thermal electrical, chemical); computer aided design apparatus or concepts; immediate prototyping in product design; installation, combination of theory and practice. Analysis of failure: definition and types of failure/damage/ wear and tear; degradation and stabilizer; factors that affect failure such as processing, service, and environment including weather. Characterization and failure analysis (failure factor ratio); estimation of failure and analysis model for accelerated failure, FEA technique function; computer aided failure or hardware/software failure prediction or programme such as CPA. **Assessment:** Coursework 40%, Final Examination 60%	Dr. Nadras Othman 04-599 6177 srnadras@eng.usm.my Dr. Zulkifli Mohamad Ariff 04-599 6173 zulariff@eng.usm.my
EBP 401 Final Year Research Project	6	II	Each student will be given a research title and he or she will be required to conduct whatever investigation or research in connection to the title. At the end of the semester each student will have to make an oral presentation and a report or dissertation **Assessment:** Coursework 100%	Dr. Zulkifli Mohamad Ariff 04-599 6173 zulariff@eng.usm.my
EBP 402 Mould and Die Design	3	II	Selection criterion for selecting materials for mould and die; design criterion and detailed analysis using computer design software; design of 2-plate mould, multiple-plate mould, runnerless mould, side core etc.; die design to produce rod, tube, sheet and profile. Flow characteristics in mould and gate; calculations of parameters for mould feed system, force to eject product, distortion of product wall, and the variables for mould cooling. Flow characteristics in die, pressure gradient, die dimensions, and output of die. Designing of mould or die for a specific polymer product using manual technique and computer (CAD). **Assessment:** Coursework 40%, Final Examination 60%	Assoc. Prof. Azhar Abu Bakar 04-599 6102 azhar@eng.usm.my Assoc. Prof. Hazizan Md. Akil 04-599 6161 hazizan @eng.usm.my Dr. Zulkifli Mohamad Ariff 04-599 6173 zulariff@eng.usm.my

School of **Materials and Mineral Resources Engineering**

EBP 412 Specialty Engineering Polymers	3	II	Definition and classification: structure behavior and relation between applications and various polymer types such as liquid crystalline polymer (LCP), floropolymer, ionomer, biodegradation, and biomedical polymers, polyelectrolyte, polymers for electronic and electrical applications; polymers for special packaging and medical applications; polymers for heavy engineering applications. Focus on the unique combination of properties and specific applications of specialty polymers. Polymer blend/alloy: basic concepts in improving properties with polymer blending/alloying; functions of polymer blending, type/ratio, blend conditions: interphase (miscible, non-miscible, compatible) within the polymer blend. Mixing rules, compatibility concept and optimization; structure/property/ and application relationship in commercial polymer blend/alloy such as crystal/amorphous, amorphous/amorphous. Rubber/plastic etc. effect of additives such as filler, reinforcement and curatives. **Assessment:** Coursework 40%, Final Examination 60%	Prof. Zakaria Mohd. Amin 04-599 6117 srzakaria@eng.usm.my Dr. Zulkifli Ahmad 04-599 6183 zulkifli@eng.usm.my
EBP 415 Fiber Processing	3	I	Introduction to fiber: classification and definition. Introduction to fiber forming polymers. Processing and manufacturing of fiber: polymer solubility, preparation of spinning solution, fiber formation, wet spinning, dry spinning and melt spinning. Fiber after modification: coloring, finishing, lubricating and others. Fiber drawing processes: stretching and orientation as well as drawing techniques. Thermal treatment: techniques of thermal treatment and effect of thermal treatment on fiber properties. Fiber properties: geometrical characteristics of structure, physical, chemical and factors that influence fiber properties. Product and fiber applications. **Assessment:** Coursework 40%, Final Examination 60%	Assoc. Prof. Azlan Arifin 04-599 6176 azlan@eng.usm.my Dr. Razaina Mat Taib 04-599 6123 razaina@eng.usm.my
EBP 418 Plastic Processing Laboratory	2	I	**Experiment 1: Investigation of polymer melts properties** Using melt flow indexer (MFI) as a simple capillary rheometer to investigate the characteristic of plastic flow (6 hours). **Experiment 2: Production of pre-preg by using pultrusion technique** Using pultrusion machine to prepare a continuous fibre impregnated thermoplastic (COFIT) composite or pre-preg and to characterize it (8 hours). **Experiment 3: Preparation of polyvinyl chloride (PVC) compound** PVC compound will be prepared by using dry mixer and moulded. The prepared compounds then will be characterized (8 hours). **Experiment 4: Extrusion technique** Using the single screw extruder to investigate the effect of processing parameters on the extrudate quality (6 hours). **Experiment 5: Thermal forming of thermoplastic materials** Using oven to study the concept of thermal forming and to produce a product by using this method (4 hours). **Experiment 6: Production of plastic films** Using the extrusion blown film machine to produce a plastic film. Films that was produced with different processing parameters will be characterized (6 hours). **Experiment 7: Polymer identification** Using basic techniques such as flammability, solubility, plasticity etc. to identify different types of polymers (6 hours). **Experiment 8: Injection moulding technique** Using injection moulding machine to investigate the optimum freeze time (4 hours). **Experiment 9: Plastic compounding by using heated two-roll mill** To compound plastic and additives by using heated two-roll mill and to investigate the efficiency of that compounding technique (6 hours). **Experiment 10: Preparation of thermoset composite** To prepare thermoset polymer composite by using hand lay-up technique and to characterize the composite produced (6 hours). **Assessment:** Coursework 100%	Assoc. Prof. Chow Wen Shyang 04-599 6160 shyang@eng.usm.my

EBP 420 Rubber Engineering	2	I	Application of mathematics in rubber elasticity: classical, statistical, and phenomological. Effect of reinforcement on young, shear, and bulk elasticity moduli. Concept and behavior of force-deformation: compression, shear, combined compression and shear, torque, bending and buckling. Effect of structure and lamination. Models: inclined rubber mounting and slender column, application in bridge bearing, dock fender, and others. Dynamic mechanical behavior: storage and loss modulus, tan δ. Damping and hysterises. Interpretation of tyre behavior such as wet grip, rolling resistance, vibration isolation, and transmissibility. **Assessment:** Coursework 40%, Final Examination 60%	Dr. Azura A. Rashid 04-599 6111 azura@eng.usm.my

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