THE HONG KONG POLYTECHNIC UNIVERSITY
香港理工大學

DEPARTMENT OF APPLIED PHYSICS
應用物理學系

Bachelor of Science (Honours) in Engineering Physics [Optoelectronics]

Programme code: 11439-OPT

DEFINITIVE PROGRAMME DOCUMENT

2-year curriculum intake cohort 2015/16

THE HONG KONG POLYTECHNIC UNIVERSITY

DEPARTMENT OF APPLIED PHYSICS

DEFINITIVE PROGRAMME DOCUMENT

OF

BACHELOR OF SCIENCE (HONOURS) IN ENGINEERING PHYSICS
[OPTOELECTRONICS]

(Code-Stream : 11439-OPT)

2-year curriculum intake cohort 2015/16

Version: September 10, 2015

Contents

1. INTRODUCTION

This is an articulation programme for Higher Diploma/Associate Degree graduates in Science or Engineering. It also serves as a specialized stream of study for our existing Bachelor of Science (Honours) in Engineering Physics programme. The curriculum is designed to provide students with 65 credits (two years) of solid training in applied physics with a specialism in optoelectronics. The programme conforms to the common framework of the University for Bachelor's degree, including language training, work-integrated education, co-curricular activity and General University Requirements. On successful completion of the programme, students will be awarded a degree of Bachelor of Science (Honours) in Engineering Physics [Optoelectronics]. The present document gives a description of the aims, structure and content of this credit-based programme.

2. GENERAL INFORMATION

Programme Title	:	BSc (Hons) in Engineering Physics [Optoelectronics]
Programme-stream Code	:	11439-OPT
Host Department	:	Department of Applied Physics
Medium of Instruction: English		
Mode of Study	:	Full-time
Duration	:	2 years normal, 4 years maximum
Entry Qualification	:	Higher Diploma/Associate Degree or equivalent *(please refer to Entrance Requirements section for details)*
Requirements for Graduation	:	65 credits and University Graduation Requirements
Final Award	:	BSc (Hons) in Engineering Physics [Optoelectronics] 工程物理學(榮譽)理學士學位 [光電子學]
Annual intake number	:	30

3. BACKGROUND

Optoelectronic industry has entered the new millennium with extraordinary impelling force. Today optoelectronic/photonic products have infiltrated to all aspects of our daily life. Novel optoelectronic devices have grown evermore and fast. They find applications in communications, medicine, electronics, manufacturing and consumer products, and automotive parts, to name but a few. It is now almost impossible to think of life without optoelectronics.

Industry in Hong Kong and the Pearl River Delta region is particularly drawn to this rapidly developing field as the Mainland represents one of the world's most dynamic markets for optoelectronics. They are moving quickly from the traditional manual labour intensive manufacturing to high-return and high-technology oriented production and R&D. Consequently high caliber workforce with advanced technical and scientific know-how is in great demand. Specialists in optoelectronics at bachelor's level are needed.

4. OBJECTIVES AND PROGRAMME OUTCOMES

4.1 Objectives

The primary aim of this programme is to provide articulation programme in optoelectronics for Higher Diploma/Associate Degree graduates. It also serves to furnish our existing BSc (Hons) in Engineering Physics programme with a specialism in optoelectronics. To address the needs of the industries in Hong Kong and the Pearl River Delta region, the optoelectronic curriculum will emphasize optoelectronics system design, processing and testing. The two-year programme will produce graduates at Bachelor's level with good knowledge of applied physics and a solid training in optoelectronics.

4.2 Programme Outcomes

The Programme should lead to the following two categories of learning outcomes, referring to the intellectual abilities, knowledge, skills and attributes that an all-round preferred graduate should possess.

4.2.1 Category A Professional/academic knowledge and skills

The graduates should be able to:

A1	apply principles and laws in physics and in the area(s) of optoelectronic engineering to analyze related scientific and technical/technological problems;
A2	apply the principles, methodologies and skills for experimental observation and interpretation for scientific and engineering purposes, especially in optoelectronic materials science and technology;
A3	formulate scientific and engineering problems in suitable mathematical or computable forms, and be able to make good judgement on the appropriateness of approximations and the derived results/answers;
A4	assimilate and implement new ideas resourcefully so as to become more flexible and adaptable to function in different employment environments and to cope with advance and change; and
A5	develop a career in optoelectronics related professions by making use of the solid foundation built in the study.

4.2.2 Category B Attributes for all-roundedness

PolyU aspires to develop all its students as all-round graduates with professional competence, and has identified a set of highly valued graduate attributes as the learning goals for students.

The graduates should (or are expected to) possess the following attributes:

B1	be able to analyze, evaluate, synthesize and propose solutions to problems of a general nature, with innovative/creative ideas where appropriate;
B2a	be able to communicate clearly and effectively in English;
B2b	be able to communicate clearly and effectively in Chinese, including Cantonese and Putonghua;
B3	be able to collaborate smoothly with others in team work, to demonstrate a sense of responsibility, accountability, leadership and team spirit;
B4	possess a desire for life-long learning and self-learning; and
B5	possess a global outlook and an understanding of China Mainland in comparison with Hong Kong.

While many of these graduate attributes can be developed through the curricular activities of this Programme, some including communication skills, leadership and global outlook are primarily addressed through co-curricular activities offered by faculties, departments, and various teaching and learning support units of the University. Students are encouraged to make full use of such opportunities to develop these attributes.

These outcomes will be achieved by using different teaching/learning methods and various assessment tools as well as a set of criterion-referenced assessment grades in each subject. Detailed subject syllabuses and assessment schemes are given in Appendix I.

5. ENTRANCE REQUIREMENTS

The minimum entrance requirement is an Associate Degree in Applied Science or Engineering, a Higher Diploma in Applied Physics, Applied Optics, Engineering of relevant areas, or the equivalent. Alternatively, a student who is in the programme of BSc (Hons) in Engineering Physics (EP) and has completed the first 2 years of study can opt for entering this study route.

6. THE CREDIT-BASED PROGRAMME

6.1 The Programme is operated under the credit-based system of the University and subject to the regulations of the system. This system provides flexibility in the curriculum as well as in the pace with which students can progress through the Programme.

6.2 Under the credit-based system, the University academic year consists of two teaching semesters, each of thirteen weeks, plus a Summer Term of seven weeks' duration.

6.3 Each subject of the Programme has a value expressed in terms of credits. A grade point system is used for subject assessment. The Grade Point Average (GPA) is a measure of the overall performance of the subjects accumulated (see "Grading" section).

7. CURRICULUM OF FULL-TIME BSC (HONS) IN ENGINEERING PHYSICS [OPTOELECTRONICS]

Stage/ Semester	Subject Code	Subject	Credit	Compulsory/ Elective	Pre-requisite/co-requisite/exclusion
3/1	AP30013	Photonics Laboratory	3	C	
3/1	AP30005	Advanced Scientific Instrumentation	3	C	
3/1	AP30009	Laser Principles and Applications	3	C	
3/1	ELC3121	English for Scientific Communication (DSR Language)	2	C	
3/1		CAR I (GUR) *	3	C	
		Credits for Year 3, Semester 1	***14***		
3/2	AP20001	Electromagnetism	3	C	
3/2	AP30011	Solid State Physics	3	C	
3/2	AP30007	Optical Design	3	C	
3/2	AP40006	Semiconductor Materials and devices	3	C	
3/2	AP20006	Quantum Mechanics for Scientists and Engineers	3	C	
3/2	CBS2212P	Chinese Communication for Professionals of Applied Sciences (DSR Chinese)	2	C	
		Credits for Year 3, Semester 2	***17***		
4/1	AP30014	Science and Technology of Photovoltaics	3	C	
4/1	AP40002	Display Technology	3	C	
4/1	AP40003	Solid State Lighting	3	C	
4/1		Service-Learning (GUR)	3	E	
4/1	AP30012	Thermal and Statistical Physics	3	C	AP20006
4/1	AP40004	Project (yearly subject)	2	C	
		Credits for Year 4, Semester 1	***17***		
4/2	AP40009	Advanced Photonics Laboratory	3	C	
4/2	AP40005	Optoelectronic	3	C	

		Packaging and Reliability			
4/2	AP30003	Detectors and Imaging Devices	3	C	
4/2	AP40010	Lighting Control Technology	3	C	
4/2		CAR II (GUR) *	3	C	
4/2	AP40004	Project (yearly subject)	2	C	
		Credits for Year 4, Semester 2	***17***		
		Total:	**65**		

* Three additional requirements (ER/EW, CR/CW, and CSR) must be fulfilled within the two CAR subjects.

Remarks:

GUR-General University Requirements
CAR-Cluster Areas Requirement
DSR-Discipline Specific Requirements
ER/EW-English Reading and Writing Requirements
CR/CW-Chinese Reading & Writing Requirements
CSR-China Study Requirement

8. CURRICULUM MAP

This curriculum map gives a holistic view of the degree to which each intended learning outcome will be taught and assessed in this programme.

I (Introduction)	The learning leading to the particular intended outcome is introduced in that subject.
R (Reinforcement)	The learning leading to the particular intended outcome is reinforced in that subject.
A (Assessed)	The performance which demonstrates the particular intended outcome is assessed in that subject.

Programme outcomes / **Subjects**	**A1**	**A2**	**A3**	**A4**	**A5**	**B1**	**B2a**	**B2b**	**B3**	**B4**	**B5**
AP30013 Photonics Laboratory	**A**	**R**		**R**	**R**	**R**					
AP30005 Advanced Scientific Instrumentation	**A**	**R**		**R**	**R**				**R**		
AP30009 Laser Principles and Applications	**A**		**R**		**R**	**R**					
ELC3121 English for Scientific Communication (DSR Language)							**R**			**R**	
CAR I (GUR)*										**R**	
AP20001 Electromagnetism	**A**		**I**			**I**					
AP30011 Solid State Physics	**A**		**R**			**R**					

AP30007 Optical Design	**A**	**A**	**R**		**R**	**R**					
AP40006 Semiconductor Materials and Devices	**A**	**A**			**R**	**R**					
AP20006 Quantum Mechanics for Scientists and Engineers	**A**		**A**			**I**					
CBS2212P Chinese Communication for Professionals of Applied Sciences (DSR Chinese)								**R**		**R**	
AP30014 Science and Technology of Photovoltaics	**A**	**A**			**R**	**R**					
AP40002 Display Technology	**A**	**A**			**R**	**R**					
AP40003 Solid State Lighting	**A**	**A**			**R**	**R**					
Service-Learning (GUR)									**A**	**R**	**R**
AP30012 Thermal and Statistical Physics	**A**		**R**			**R**					
AP40009 Advanced Photonics Laboratory		**A**		**R/A**	**R**	**R**			**R**		
AP40005 Optoelectronic Packaging and Reliability	**A**	**A**			**R**	**R**					
AP30003 Detectors and Imaging Devices	**A**	**A**		**R**							
AP40010 Lighting Control Technology	**A**	**A**			**R**	**R**					
CAR II (GUR)*										**R**	
AP40004 Project (yearly subject)	**A**	**A**	**A**	**A**	**A**	**R/A**	**A**	**R**	**A**	**R**	

9. ADMISSION AND REGISTRATION

9.1 Students accepted for admission to the Programme will be informed by the Academic Secretariat of the procedure that they must follow in order to be registered.

9.2 Student status

9.2.1 Students who enroll on the Programme with a study load of 9 credits or more in a semester are classified as full time students. They are expected to devote the whole of their time to study and to activities related to their studies. Classes are also predominantly scheduled in the daytime.

9.2.2 Full-time students are normally expected to follow the specified progression pattern shown in the curriculum table.

9.2.3 Students who do not follow the specified progression pattern strictly, but who will pay the full-time flat fee, will still be recognized as full-time students.

9.2.4 Full-time local students are eligible to apply for financial assistance from the Government in the form of grant and loan.

9.2.5 Full-time students may not be granted the Government grant and loan beyond the normal period of study for the Programme.

9.2.6 Students who wish to study at their own pace instead of following the specified progression pattern will have to seek prior approval from the Department. These students are referred to as self-paced students.

9.2.7 Students who have been given permission to take less than 9 credits in a semester will be given the option to pay credit fees instead of the full-time flat fee. If students wish to exercise such option, they have to inform the Department before the end of the add/drop period of that semester. These credit fee paying students are classified as part-time students for that semester.

9.2.8 Students who wish to change their status, from full-time to part-time, i.e. enrolling for less than 9 credits in a semester, have to seek prior approval from the Department.

9.3 Subject registration

9.3.1 In addition to programme registration, students need to register for the subjects at specified periods for each semester. The schedule for subject registration includes a two-week add-drop period for both Semesters One and Two and a one-week add/drop period for the Summer Term.

9.3.2 Students will be allowed to take additional subjects for broadening purpose, after they fulfill the graduation requirements and for the following semester. However, they will still be subject to the maximum study load of 21 credits per semester and the availability of places in the subjects concerned, and their enrolment will be as subject-based students only.

9.3.3 Students are advised to register on General University Requirement (GUR) subjects according to the schedule of the curriculum table.

9.4 Credit requirement by semester

9.4.1 For students following the specified progression pattern, the number of credits which they have to take in each semester is defined in the curriculum table.

9.4.2 The maximum number of credits to be taken by a student in a semester is 21 credits.

9.4.3 Students will not be allowed to take zero subject in any semester unless they have obtained prior approval from the Department; otherwise they will be classified as having unofficially withdrawn from their study. Any semester in which the students are allowed to take zero subject will nevertheless be counted towards the maximum period of registration.

9.5 Exemption and credit transfer

9.5.1 Students may be exempted from taking any specified subjects, including mandatory GUR subjects, if they have successfully completed similar subjects previously in another programme or have demonstrated the level of proficiency/ability to the satisfaction of the subject offering department. Subject exemption is normally decided by the subject offering department. However, for applications that are submitted by students who have completed an approved student exchange programme, the subject exemption is to be decided by the Department in consultation with the subject offering departments. In case of disagreement between departments, the

faculty deans concerned will make a final decision jointly on the application. If students are exempted from taking a specified subject, the credits associated with the exempted subject will not be counted towards the award requirements (except for exemption granted at the admission stage). It will therefore be necessary for the students to take another subject in order to satisfy the credit requirement for the award.

9.5.2 In the case of credit transfer, students will be given credits for recognized previous study [including mandatory GUR subjects (except for full-time articulation Bachelor's degree programmes, where only exemptions are to be given)]; and the credits will be counted towards meeting the requirements of the award. Transferred credits may be counted towards more than one award. Credit transfer may be done with the grade carried or without the grade carried; the former should normally be used when the credits were gained from PolyU. Subject credit transfer is normally decided by the subject offering department. However, for applications that are submitted by students who have completed an approved student exchange programme, the decision will be made by the Department in consultation with the subject offering departments. In case of disagreement between departments, the faculty deans concerned will make a final decision jointly on the application. The validity period of credits previously earned is 8 years after the year of attainment.

9.5.3 Normally, not more than 50% of the credit requirement for award may be transferable from approved institutions outside the University. For transfer of credits from programmes offered by PolyU, normally not more than 67% of the credit requirement for award can be transferred. In cases where both types of credits are being transferred (i.e. from programmes offered by PolyU and from approved institutions outside the University), not more than 50% of the credit requirement for award may be transferred.

9.5.4 If a student is waived from a particular stage of study on the basis of advanced qualifications held at the time of admission, the student concerned will be required to complete fewer credits for award. For these students, the exempted credits will be counted towards the maximum limit for credit transfer when students apply for further credit transfer after their admission.

9.5.5 Credit transfer can be applicable to credits earned by students through study at an overseas institution under an approved exchange programme. Students should, before they go abroad for the exchange programme, seek prior approval from the Department.

9.6 Deferment of study

9.6.1 Deferment of study is applicable to those students who have a genuine need to do so such as illness or posting to work outside Hong Kong. Approval from the Department is required. The deferment period will not be counted towards the maximum period of registration.

9.6.2 No deferment of study will be permitted unless it remains possible for the student to obtain the relevant award within the maximum period of registration.

9.6.3 Application for deferment of study will be entertained only in exceptional circumstances from students who have not yet completed the first year of the Programme.

9.6.4 Where the period of deferment of study begins during a stage for which fees have been paid, no refund of such fees will be made.

10. ASSESSMENT AND PROGRESSION

10.1 Assessment methods

10.1.1 Students' performance in a subject shall be assessed by coursework, practical test and/or examinations. The weighting of each in the overall subject grade is stated in the respective subject description form.

10.1.2 Coursework may include tests, assignments, projects, laboratory work, field exercises, presentations and other forms of classroom participation. The contribution made by each student in coursework involving a group effort shall be determined and assessed separately.

10.1.3 For any subject offered by a servicing department (with subject code not beginning with 'AP'), a student must satisfy requirements that may be stipulated by the servicing department concerned in order to achieve an overall passing grade.

10.1.4 At the beginning of each semester, each subject teacher should inform students of the details of the assessment methods to be used.

10.1.5 The Board of Examiners is appointed to deal with special cases arising from assessment and classification of awards.

10.1.6 Assessment of Work-Integrated Education (WIE)

The objective of the assessment is to determine to what extent the student has achieved the intended learning outcomes of the WIE component. The WIE learning outcomes are as follow:

- achieve goals or tasks as specified by the employer in a working environment;
- be able to analyze, evaluate, synthesize and propose solutions to problems of a general nature;
- be able to communicate and collaborate effectively with others;
- possess a global outlook (for an overseas placement) or deepen the understanding of Mainland (for placement in Mainland); and become experienced in adapting to real working environment.

The WIE component carries 1 training credit which is roughly equivalent to 30 working hours. A student is required to accrue at least one WIE training credit before graduation. Students are strongly encouraged to finish their WIE requirement by the end of the summer of year 3. The component is not counted towards GPA calculation nor award classification. Some staff in the department may provide WIE placements from projects and work placements in collaboration with external organizations. The students themselves are also allowed to seek for WIE placements themselves or via job postings advertised by the Student Affairs Office as long as the students obtain approval from the department.

The following is the WIE assessment method.

(i) Report
Upon completion of the placement, the student is required to submit a report summarizing his/her work experience and the learning outcomes that have been achieved.

(ii) Performance Evaluation
At the end of the WIE placement, the workplace supervisor will provide a performance evaluation by answering a set of questions related to the achievement of intended WIE learning outcomes. The student's supervisor from AP will also give assessment at the end of the placement.

(iii) Overall Assessment
Based on the report submitted by the student and the performance evaluation, a Pass grade will be given upon satisfactory completion of the intended WIE learning outcomes; otherwise a failure grade will be given.

10.2 Progression

10.2.1 The Board of Examiners shall, at the end of each semester, determine whether each student is

(i) eligible for progression towards an award; or

(ii) eligible for an award; or

(iii) required to be deregistered from the programme.

10.2.2 A student will have 'progressing' status unless he/she falls within the following categories, either of which may be regarded as grounds for deregistration from the programme:

(i) the student has exceeded the maximum period of registration for that programme, as specified in the Definitive Programme Document; or

(ii) the student's GPA (see "Grading" section) is lower than 2.0 for two consecutive semesters and his/her Semester GPA in the second semester is also lower than 2.0; or

(iii) the student's GPA is lower than 2.0 for three consecutive semesters; or

(iv) the student's academic performance is poor to the extent that the Board of Examiners deems that his/her chance of attaining a GPA of 2.0 at the end of the programme is slim or impossible.

10.2.3 When a student has a GPA lower than 2.0, he/she will be put on academic probation in the following semester. If a student is able to pull his GPA up to 2.0 or above at the end of the semester, the status of "academic probation" will be lifted. The status of "academic probation" will be reflected in the examination result notification but not in the transcript of studies.

10.3 Retaking of subjects

10.3.1 Students may retake any subject for the purpose of improving their grade without having to seek approval, but they must retake a compulsory subject which they have failed, i.e. obtained an F grade.

10.3.2 Retaking of subjects is with the condition that the maximum study load of 21 credits per semester is not exceeded.

10.3.3 Students wishing to retake passed subjects will be accorded a lower priority than those who are required to retake (due to failure in a compulsory subject) and can only do so if places are available.

10.3.4 The number of retakes of a subject is not restricted. Only the grade obtained in the final attempt of retaking (even if the retake grade is lower than the original grade for originally passed subject) will be included in the calculation of the Grade Point Average (GPA). If students have passed a subject but failed after retake, credits accumulated for passing the subject in a previous attempt will remain valid for satisfying the credit requirement for award. (The grades obtained in previous attempts will only be reflected in transcript of studies.)

10.3.5 In cases where a student takes another subject to replace a failed elective subject, the fail grade will be taken into account in the calculation of the GPA, despite the passing of the replacement subject.

10.4 Exceptional circumstances

10.4.1 *Absence from an assessment component*: If a student is unable to complete all the assessment components of a subject due to illness or other circumstances which are beyond his/her control, and considered by the Board of Examiners as legitimate, the Board will determine whether the student will have to complete a late assessment and, if so, by what means. This late assessment shall take place at the earliest opportunity, and before the commencement of the following academic year (except that for Summer Term, which may take place within 3 weeks after the finalization of Summer Term results). The student will not receive a grade for the subject prior to his/her completion of the assessment component(s). The student concerned is required to submit his/her application for late assessment in writing to the Head of Department offering the subject, within five working days from the date of the examination, together with any supporting documents. Approval of applications for late assessment and the means for such late assessments shall be given by the Head of Department offering the subject or the Subject Lecturer concerned, in consultation with the Programme Leader.

10.4.2 *Other particular circumstances*: A student's particular circumstances may influence the procedures for assessment but not the standard of performance expected in assessment.

10.5 Grading

10.5.1 Assessment grades shall be awarded on a criterion-referenced basis. A student's overall performance in a subject is graded as follows :

Subject Grade	***Grade Point***	***Short Description***	***Elaboration on Subject Grading Description***
A+	4.5	Exceptionally Outstanding	The student's work is exceptionally outstanding. It exceeds the intended subject learning outcomes in all regards.
A	4	Outstanding	The student's work is outstanding. It exceeds the intended subject learning outcomes in nearly all regards.
B+	3.5	Very Good	The student's work is very good. It exceeds the intended subject learning outcomes in most regards.
B	3	Good	The student's work is good. It exceeds the intended subject learning outcomes in some regards.
C+	2.5	Wholly Satisfactory	The student's work is wholly satisfactory. It fully meets the intended subject learning outcomes.
C	2	Satisfactory	The student's work is satisfactory. It largely meets the intended subject learning outcomes.
D+	1.5	Barely Satisfactory	The student's work is barely satisfactory. It marginally meets the intended subject learning outcomes.
D	1	Barely Adequate	The student's work is barely adequate. It meets the intended subject learning outcomes only in some regards.
F	0	Inadequate	The student's work is inadequate. It fails to meet many of the intended subject learning outcomes.

'F' is a subject failure grade, whilst all other ('D' to 'A+') are subject passing grades. No credit will be earned if a subject is failed. The learning outcomes of the subjects can be found at the website *http://ap.polyu.edu.hk*.

10.5.2 At the end of each semester, a Grade Point Average (GPA) will be computed as follows, and based on the grade point of all the subjects :

$$GPA = \frac{\sum_{n} \text{Subject Grade Point} \times \text{Subject Credit Value}}{\sum_{n} \text{Subject Credit Value}}$$

where n = number of all subjects (inclusive of failed subjects) taken by the student up to and including the latest semester/term, but for subjects which have

been retaken, only the grade obtained in the final attempt will be included in the GPA calculation.

In addition, the following subjects will be excluded from the GPA calculation:

(i) Exempted subjects

(ii) Ungraded subjects

(iii) Incomplete subjects

(iv) Subjects for which credit transfer has been approved without any grade assigned

(v) Subjects from which a student has been allowed to withdraw (i.e. those with the grade 'W')

Subject which has been given an "S" subject code, i.e. absent from examination, will be included in the GPA calculation and will be counted as "zero" grade point. GPA is thus the unweighted cumulative average calculated for a student, for all relevant subjects taken from the start of the programme to a particular point of time. GPA is an indicator of overall performance and is capped at 4.0.

10.5.3 The grades and codes for the subject and final assessments are included in Appendices II and III.

10.5.4. Different types of GPA's

10.5.4.1 GPA's will be calculated for each Semester including the Summer Term. This Semester GPA will be used to determine students' eligibility to progress to the next Semester alongside with the 'cumulative GPA'. However, the Semester GPA calculated for the Summer Term will not be used for this purpose.

10.5.4.2 The GPA calculated after the second Semester of the students' study is therefore a 'cumulative' GPA of all the subjects taken so far by students, and without applying any level weighting.

10.5.4.3 Along with the 'cumulative' GPA, a weighted GPA will also be calculated, to give an indication to the Board of Examiners on the award classification which a student will likely get if he/she makes steady progress on his/her academic studies. GUR subjects will be included in the calculation of weighted GPA.

10.5.4.4 When a student has satisfied the requirements for award, an award GPA will be calculated to determine his/her award classification. GUR subjects will be included in the calculation of award GPA.

10.5.4.5 The relationship between the different types of GPA's, and the methods for calculating each, is further explained in Appendix IV.

11. FINAL AWARD

11.1 Graduation requirements

11.1.1 A student would be eligible for award of a BSc(Hons) in EP [Opto] if he/she satisfies all the conditions listed below.

1. Complete successfully a minimum of 65 credits.

2. Earn a cumulative GPA of 2.00 or above at graduation
3. Complete successfully the mandatory Work-Integrated Education (WIE) component as specified by the programme.
4. Satisfy the residential requirement for at least 1/3 of the credits to be completed for the award of BSc(Hons) in EP [Opto].

5. Satisfy the following GUR requirements:

(a) Cluster Areas Requirement (CAR)	6 credits (from different cluster area), meeting three additional requirements (ER/EW, CR/CW and CSR) within CAR I and CAR II
(c) Service-Learning	3-credit free elective subject
(d) Language and Communication Requirements[1]	-
	Total = 9 credits

11.1.2 A student is required to graduate as soon as he/she satisfies all the conditions for award (see the paragraph above). He/she may take additional subjects as described in the "Subject registration" section in or before the semester within which he/she becomes eligible for award.

11.2 Guidelines for award classification

11.2.1 Classification of awards is based on the final Weighted GPA (see the following paragraph). There is no automatic conversion between the Weighted GPA and the award classification. The Board of Examiners shall exercise its judgement in coming to its conclusions as to the award for each student, and where appropriate, may use other relevant information.

11.2.2 The Weighted Grade Point Average is defined as follows:

$$\text{Weighted GPA} = \frac{\sum_{n} \text{Subject Grade Point} \times \text{Subject Credit Value} \times W_i}{\sum_{n} \text{Subject Credit Value} \times W_i}$$

where W_i is the subject level weighting with

$$W_i = \begin{cases} 2 \text{ for level I and II subjects} \\ 3 \text{ for level III and IV subjects} \end{cases}$$

[1] Students would be considered for credit transfer based on their previous studies in AD/HD programmes and their academic performance. Students not meeting the equivalent standard of the Undergraduate Degree LCR will be required to take degree LCR subjects.

The Weighted GPA will also be capped at 4.0.

11.2.3 Any subjects passed after the graduation requirement has been met will not be taken into account in the GPA or Weighted GPA calculations for award classification.

11.2.4 The following are guidelines for Boards of Examiners' reference in determining award classifications:

Honours	Guidelines
1st	The student's performance/attainment is outstanding, and identifies him/her as exceptionally able in the field covered by the Programme.
2:i	The student has reached a standard of performance/ attainment that is more than satisfactory but less than outstanding.
2:ii	The student has reached a standard of performance/ attainment judged to be satisfactory, and clearly higher than the 'essential minimum' required for graduation.
3rd	The student has attained the 'essential minimum' required for graduation at a standard ranging from just adequate to just satisfactory.

11.2.5 A Pass-without-Honours degree award will be recommended only under exceptional circumstances, when the student has demonstrated a level of final attainment which is below the 'essential minimum' required for graduation with Honours from the Programme, but when he/she has nonetheless covered the prescribed work of the Programme in an adequate fashion, while failing to show sufficient evidence of the intellectual calibre expected of Honours degree graduates. For example, if a student in an Honours degree programme has a Grade Point Average (GPA) of 2.0 or more, but his Weighted GPA is less than 2.0, he may be considered for a Pass-without-Honours classification.

11.3 Aegrotat award

11.3.1 If a student is unable to complete the requirements of the Programme for the award due to very serious illness or other very special circumstances which are beyond his control, and considered by the Board of Examiners as legitimate, the Faculty Board will determine whether the student will be granted an aegrotat award. Aegrotat award will be granted under very exceptional circumstances.

11.3.2 A student who has been offered an aegrotat award shall have the right to opt either to accept such an award, or request to be assessed on another occasion to be stipulated by the Board of Examiners; the student's exercise of this option shall be irrevocable.

11.3.3 The acceptance of an aegrotat award by a student shall disqualify him/her from any subsequent assessment for the same award.

11.3.4 An aegrotat award shall normally not be classified, and the award parchment shall not state that it is an aegrotat award. However, the Board of Examiners may determine whether the award should be classified provided that they have adequate information on the students' academic performance.

12. STUDENT APPEALS

It is the students' responsibility to make known to the Board of Examiners (with any supporting documents such as a medical certificate), through the Department, the factors they believe have detrimentally and materially affected their examination results immediately after the assessment and prior to the meeting of the relevant Board. Appeals shall be made in accordance with the procedures set out in the "Student Handbook".

13. LEAVE OF ABSENCE, DEFERMENT AND WITHDRAWAL

A student may apply for leave of absence, deferment and withdrawal in accordance with University regulations.

14. UNIVERSITY REGULATIONS

The regulations in this document are only for those which apply specifically to the BSc (Hons) in EP [Optoelectronics]. Students should consult the current issue of the "Student Handbook" for the General Regulations of the University.

(Should discrepancy between the contents of this document and University regulations arise, University regulations will always prevail.)

15. AMENDMENTS

This Definitive Programme Document is subject to review and changes which the programme offering Department can decide to make from time to time. Students will be informed of the changes as and when appropriate.

Appendix I: Subject Description Forms

Subject Description Form

Subject Code	AP20001
Subject Title	Electromagnetism
Credit Value	3
Level	2
Pre-requisite/ Co-requisite/ Exclusion	Nil
Objectives	To introduce the basic concepts and laws in electromagnetism, and to formulate the laws in vector format.
Intended Learning Outcomes	Upon completion of the subject, students will be able to: (a) understand the basic vectorial operations and their application in the formulation of electromagnetism; (b) learn the basic laws of electromagnetism in vector notation including Coulomb's law, Gauss' law, Biot-Savart law, Ampere's circuital law, and Maxwell's equations; and (c) solve problems related to electromagnetism using different analytical techniques such as image method, boundary value approaches, the symmetric conditions and energy method.
Subject Synopsis/ Indicative Syllabus	**Vectors and vector fields**: vector algebra; vector calculus & integrals, gradient, divergence, Stokes operation, the Laplacian, Curl, coordinate systems. **Time-independent Maxwell equations**: reviews the force laws of electrostatics and magnetostatics as vector field equations. **Time-dependent Maxwell equations**: the derivation of the full set of time dependent Maxwell equations. **Electrostatic calculations**: investigation of vector electric fields generated by stationary charge distributions using Maxwell's equations. Using boundary conditions, image methods, complex analysis, solution of Poisson's equations etc for the investigations. **Dielectric and magnetic media**: uses Maxwell's equations to investigate the interaction of dielectric and magnetic media with quasi-static electric and magnetic vector fields. Applications of boundary conditions for **E** & **B**. **Magnetic induction**: uses Maxwell's equations to investigate magnetic induction and related phenomena. Includes self- and mutual inductance.
Teaching/Learning Methodology	**Lecture**: The fundamentals in electromagnetism will be explained. Examples will be used to illustrate the concepts and ideas in the lecture. Homework problem sets will be given. **Student-centered Tutorial: S**tudents will work on a set of problems in tutorials. Students are encouraged to solve problems and to use their own knowledge to verify

<table>
<tr><td></td><td>their solutions before seeking assistance. These problem sets provide them opportunities to apply their knowledge gained from the lecture. They also help students to consolidate what they have learned. Furthermore, students can develop a deeper understanding of the subject in relation to daily life phenomena or experience.</td></tr>
<tr><td>Assessment Methods in Alignment with Intended Learning Outcomes</td><td>
<table>
<tr><td rowspan="2">Specific assessment methods/tasks</td><td rowspan="2">% weighting</td><td colspan="3">Intended subject learning outcomes to be assessed (Please tick as appropriate)</td></tr>
<tr><td>a</td><td>b</td><td>c</td></tr>
<tr><td>(1) Continuous assessment</td><td>40</td><td>✓</td><td>✓</td><td>✓</td></tr>
<tr><td>(2) Examination</td><td>60</td><td>✓</td><td>✓</td><td>✓</td></tr>
<tr><td>Total</td><td>100</td><td colspan="3"></td></tr>
</table>

The continuous assessment includes assignments, quizzes and tests which aim at checking the progress of students study throughout the course, assisting them in fulfilling the learning outcomes.
Assignments will strengthen the students’ basic knowledge and the analytical skill to solve the problems related to electromagnetism. Tests will review their understanding of the course and examination will improve their manipulation on problem solving.</td></tr>
<tr><td>Student Study Effort Expected</td><td>
<table>
<tr><td>Class contact:</td><td></td></tr>
<tr><td>• Lecture</td><td>33 h</td></tr>
<tr><td>• Tutorial</td><td>6 h</td></tr>
<tr><td>Other student study effort:</td><td></td></tr>
<tr><td>• Self-study</td><td>81 h</td></tr>
<tr><td>Total student study effort</td><td>120 h</td></tr>
</table>
</td></tr>
<tr><td>Reading List and References</td><td>R. Fitzpatrick, “Maxwell’s Equations and the Principles of Electromagnetism”, Infinity Science Press LLC, 2008.

W.H. Hayt, and J.A. Buck, “Engineering Electromagnetics”, 7th Edition McGraw-Hill, 2006.

D.K. Cheng, “Fundamentals of Engineering Electromagnetics”, Addison-Wesley, 1993.</td></tr>
</table>

Subject Description Form

Subject Code	AP20006
Subject Title	Quantum Mechanics for Scientists and Engineers
Credit Value	3
Level	2
Pre-requisite/ Co-requisite/ Exclusion	Nil
Objectives	The aims of this subject are to introduce some of the main concepts of quantum theory and its applications to some important physical systems including solids and semiconductors.
Intended Learning Outcomes	Upon completion of the subject, students will be able to: (a) articulate the experimental basis for attributing particle properties to waves and wave properties to particles; elaborate on the de Broglie theory of matter waves; apply Heisenberg's uncertainty principle to simple systems; (b) elaborate on the various forms of Schrödinger's equation and identify the meaning of each term in the equation(s); solve Schrödinger's equation for the problem of particle in a box; (c) formulate time-independent Schrödinger's equations for the hydrogen molecular ion, the hydrogen molecule and other complex molecules; and (d) describe the scientific ideas behind the historical atomic models and recognize and justify the various modifications of classical ideas as new experimental evidences emerged; use Bohr's semiclassical model to interpret energy levels and spectra and recognize the limitations of the model.
Subject Synopsis/ Indicative Syllabus	**Particle properties of waves**: photoelectric effect, wave-particle duality, Compton effect, photons. **Wave properties of particles**: de Broglie hypothesis, uncertainty principle. **Schrődinger's equation**: time-independent and time-dependent Schrődinger's equations, rigid box, non-rigid box, three-dimensional Schrődinger equation, angular momentum, harmonic oscillator. **Atomic physics**: Atomic spectra of gases, Bohr's model, quantum model, wave functions, quantum numbers, exclusion principle, periodic table, spontaneous and stimulated lasers. **Electron spin**: spin angular momentum, magnetic moments, the Zeeman effect and spin magnetic moments.
Teaching/Learning Methodology	**Lecture**: the fundamentals in quantum mechanics will be explained. Examples will be used to illustrate the concepts and ideas in the lecture. The students are free to request help. Homework problem sets will be given. The students are encouraged to solve problems and to use their own knowledge to verify their solutions before seeking assistance.

Student-centered Tutorial: students work on sets of problems in the tutorials. Students are encouraged to solve problems before seeking assistance. These problem sets provide them opportunities to apply the knowledge gained from the lecture's. They also help the students to consolidate what they have learned. Furthermore, students can develop a deeper understanding of the subject in relation to daily life phenomena or experience.

e-learning: in order to enhance the effectiveness of teaching and learning processes, electronic means and multimedia technologies would be adopted for presentations of lectures; communication between students and lecturer; delivery of handouts, homework and notices etc.

Assessment Methods in Alignment with Intended Learning Outcomes

Specific assessment methods/tasks	% weighting	Intended subject learning outcomes to be assessed (Please tick as appropriate)			
		a	b	c	d
(1) Continuous assessment	40	✓	✓	✓	✓
(2) Examination	60	✓	✓	✓	✓
Total	100				

Continuous assessment:
The continuous assessment includes assignments, quizzes and test(s) which aim at checking the progress of students study throughout the course, assisting them in fulfilling the learning outcomes.
Assignments in general include end-of-chapter problems, which are used to reinforce and assess the concepts and skills acquired by the students; and to let them know the level of understanding that they are expected to reach.
At least one test would be administered during the course of the subject as a means of timely checking of learning progress by referring to the intended outcomes, and as means of checking how effective the students assimilate and consolidate the materials taught in the classes.

Examination: This is a major assessment component of the subject. It would be a closed-book examination. Complicated formulas would be given to avoid rote memory, such that the emphasis of assessment would be put on testing the understanding, analysis and problem solving ability of the students.

Student Study Effort Expected

Class contact:	
• Lecture	33 h
• Tutorial	6 h
Other student study effort:	
• Self-study	81 h
Total student study effort	120 h

Reading List and References

David A.B. Miller, "Quantum Mechanics for Scientists and Engineers", 2008, Cambridge University Press.

J.W. Jewett and R.A. Serway, "Physics for Scientists and Engineers", Volume 2, 8th Edition, 2010, Cengage Learning.

Subject Description Form

Subject Code	AP30003
Subject Title	Detectors and Imaging Devices
Credit Value	3
Level	3
Pre-requisite/ Co-requisite/ Exclusion	Nil
Objectives	This course covers optical detectors and imaging systems from an engineer's point of view. It develops a comprehensive understanding of the engineering application of light, and its uses within detector and imaging systems. It also leads to a review of the instrumentation and techniques involved in imaging and their role in optoelectronics.
Intended Learning Outcomes	Upon completion of the subject, students will be able to: (a) outline and explain the basic principles of classical radiometry; (b) apply blackbody radiation theory to solve problems in radiometry of incoherent sources; (c) describe and explain the physical characteristics of commonly used detector and imaging systems; (d) evaluate detector systems on the basis of their published characteristics e.g. signal to noise ratio, sensitivity; (e) develop figures of merit for optical detectors to compare the performance of different detectors; and (f) describe and discuss design issues in the development of an imaging system; solve problems on the design of detectors and imaging devices.
Subject Synopsis/ Indicative Syllabus	**Introduction:** radiometry, blackbody radiation laws, point sources and extended sources, thermal radiation, radiative energy transfer, radiation noise. **Optical detectors:** detection mechanisms (principles of photo detection, intrinsic photovoltaic effect, photoconductive detection, operation and characteristics of photo diodes); introduction to noise; photo detector requirements, responsivity and quantum efficiency, frequency response, figures of merit, detector performance measurement; photomultiplier tubes, multichannels and plates, concepts of charge storage and charge transfer, output readout techniques, charge-coupled device array tests, time delay integration. **Imaging systems***:* materials for optical imaging, films and digital photography, time and frequency analysis using Fourier transformation, sampling, filter and digitizing in imaging systems. **Thermal imaging:** nature of infrared radiation, IR detectors, thermal detectors.

<table>
<tr><td>Teaching/Learning Methodology</td><td>The methodology includes classroom teaching, laboratory experiments and presentation. The teaching session will focus on basic concepts and principles of detector and imaging devices, which are related to most of the learning outcomes (a–e). The laboratory session will enhance the ability of the students in using various devices for light detection and imaging systems (outcome f). Students will give presentations on the applications and designs of detector and imaging devices (outcome f).</td></tr>
<tr><td>Assessment Methods in Alignment with Intended Learning Outcomes</td><td>
<table>
<tr><td rowspan="2">Specific assessment methods/tasks</td><td rowspan="2">% weighting</td><td colspan="6">Intended subject learning outcomes to be assessed (Please tick as appropriate)</td></tr>
<tr><td>a</td><td>b</td><td>c</td><td>d</td><td>e</td><td>f</td></tr>
<tr><td>(1) Continuous assessment</td><td>40</td><td>✓</td><td>✓</td><td>✓</td><td>✓</td><td>✓</td><td>✓</td></tr>
<tr><td>(2) Examination</td><td>60</td><td>✓</td><td>✓</td><td>✓</td><td>✓</td><td>✓</td><td>✓</td></tr>
<tr><td>Total</td><td>100</td><td colspan="6"></td></tr>
</table>

Continuous assessment is based on assignments, laboratory reports, presentations, quizzes and test. The test is a one-hour written middle-term test. The examination is a 3-hour written final examination, which covers all of the key issues related to the learning outcomes.</td></tr>
<tr><td>Student Study Effort Expected</td><td>
<table>
<tr><td>Class contact:</td><td></td></tr>
<tr><td>• Lecture</td><td>26 h</td></tr>
<tr><td>• Tutorial</td><td>6 h</td></tr>
<tr><td>• Laboratory</td><td>9 h</td></tr>
<tr><td>Other student study effort:</td><td></td></tr>
<tr><td>• Self-study</td><td>79 h</td></tr>
<tr><td>Total student study effort</td><td>120 h</td></tr>
</table>
</td></tr>
<tr><td>Reading List and References</td><td>B.E.A. Saleh and M.C. Teich, “Fundamentals of Photonics”, 2nd Edition, Wiley, 2007.

R.W. Boyd, “Radiometry and the Detection of Optical Radiation”, Wiley, 1983.</td></tr>
</table>

Subject Description Form

Subject Code	AP30005
Subject Title	Advanced Scientific Instrumentation
Credit Value	3
Level	3
Pre-requisite/ Co-requisite/ Exclusion	Nil
Objectives	To introduce background knowledge and provide practical training in computer controlled measurement techniques, application of sensors and transducers (including optoelectronic devices and optical fibers), noise reduction methods in electrical measurement, and process control in engineering and physics applications.
Intended Learning Outcomes	Upon completion of the subject, students will be able to: (a) apply various sensors and transducers in combined with electrical measurement instruments to solve scientific and engineering problem; (b) specify and analyze the source of noise in electrical measurements, and use techniques such as lock-in amplifier to enhance the ratio of signal to noise; (c) explain the characteristics of computer I/O devices and interfacing, serial and parallel communications, and data acquisition systems; (d) explain and apply the feed-back loop (proportional, integral and derivative) concept in automatic control systems; and (e) specify and analyze optical optoelectronic devices in optical fiber communication.
Subject Synopsis/ Indicative Syllabus	**Computer Interfacing:** computer controlled electrical measurement with interfacing techniques such as RS-232, USB and IEEE488 interface. **Process Control Techniques:** proportional, integral and derivative (PID) process control concept in automatic control systems such as PID temperature controller. **Signal analysis:** Fourier transformation signal analysis using digital oscilloscope. **Signal noise reduction:** signal and noise characteristics and signal enhancement/noise reduction methods such as Lock-in Amplifier technique. **Optoelectronics and optical fiber communication:** optical fiber characteristics and analog/digital communications through optical fibers.
Teaching/Learning Methodology	**Lecture**: Background knowledge behind all experiments will be systematically introduced in lectures. Class work and assignments related to the content of lectures will be used to enhance students learning. Students are requested to give brief presentations on the topics related to the contents of experiments. **Laboratory session:** Students will use computer controlled instruments to conduct electrical and optical measurements as well as practice using of various sensors and transducers.

Assessment Methods in Alignment with Intended Learning Outcomes

Specific assessment methods/tasks	% weighting	Intended subject learning outcomes to be assessed (Please tick as appropriate)				
		a	b	c	d	e
(1) Continuous assessment	40	✓	✓	✓	✓	✓
(2) Practical examination	20	✓	✓	✓	✓	✓
(3) Written test	40	✓	✓	✓	✓	✓
Total	100					

Assignments will strengthen the students' basic knowledge and the analytical skills to solve the problems related to this subject. Practical examination is useful to assess students' experimental skills and knowledge learned from the lectures and lab works. Written test will review their understanding of the course and assess their ability to solve problems.

Student Study Effort Expected

Class contact:	
• Lecture	13 h
• Laboratory	39 h
Other student study effort:	
• Self-study	68 h
Total student study effort	120 h

Reading List and References

M. Tooley, "PC Based Instrumentation and Control", 3rd Edition, Oxford, Elsevier 2005.

G.P. Agrawal, "Fiber-optic Communication Systems", New York, John Wiley, 2002.

Terry Bartelt, "Instrumentation and Process Control", Clifton Park, NY: Thomson/Delmar Learning, c2007.

Subject Description Form

Subject Code	AP30007
Subject Title	Optical Design
Credit Value	3
Level	3
Pre-requisite/ Co-requisite/ Exclusion	Nil
Objectives	The objectives of this subject are to provide an up-to-date treatment of the optical design at an introductory level to students in the fields of applied optics, optical instrumentation and optoelectronics.
Intended Learning Outcomes	On completing the subject, students will be able to (a) use the ray tracing method to solve the image formation problems; locate stops and pupils of an optical system consisting of lenses, mirrors, and prisms; (b) explain the formation of the first-order aberration and the third-order aberration; identify and calculate various types of monochromatic aberrations and chromatic aberrations; (c) calculate the optical transfer function (OTF) and use the OTF to evaluate the quality of an optical system; select proper sets of aberrations and variables to construct the merit function; (d) explain the laws of illumination; calculate luminancy and optimize illumination design; (e) develop merit functions to set the tolerances; use computer program to mechanize the approach to tolerancing; (f) use the computer software, Zemax, to design an optical system (singlet/doublet, spectrometer, beam expander, double Gauss camera lenses, Newtonian telescope, Maksutov telescope, zoom lens, and chromatic prism); to correct aberration and to analyze image quality; and (g) be able to analyze, evaluate, and propose solutions to practical problems related to optics and light illumination.
Subject Synopsis/ Indicative Syllabus	paraxial optics; ray tracing; lens system, physical optics, optical materials. first-order aberrations, third-order aberrations, chromatic aberrations, image quality measures, optical transfer function (OTF), OTF computation. merit function, optical design procedures, lens design optimization, tolerance analysis. radiation, color and color rendering, practical light sources and laws of illumination, interior and exterior illumination designs, methods for calculating illumination. mini-projects on the design and optimization of singlet/doublet, spectrometer, beam expander, double Gauss camera lenses, Newtonian telescope, Maksutov telescope, zoom lens, and chromatic prism.

<table>
<tr><td>Teaching/Learning Methodology</td><td>

Lecture: The course contents will be delivered through lecture in class. Active participation in discussion by students will be encouraged. Tests and quizzes will be given to class at appropriate intervals to consolidate students' understanding of the acquired knowledge as well as to enhance their problem-solving skills.

Practical assignment: Students will be given opportunities for hands-on operations on advanced optical design software. They are expected to gain direct experience in making independent optical design. Through the process students can enhance their analytical power, problem solving skills, conceptual understanding, critical thinking and desire for life-long learning.

</td></tr>
<tr><td>Assessment Methods in Alignment with Intended Learning Outcomes</td><td>

<table>
<tr><th rowspan="2">Specific assessment methods/tasks</th><th rowspan="2">% weighting</th><th colspan="7">Intended subject learning outcomes to be assessed (Please tick as appropriate)</th></tr>
<tr><th>a</th><th>b</th><th>c</th><th>d</th><th>e</th><th>f</th><th>g</th></tr>
<tr><td>(1) Continuous assessment</td><td>40</td><td>✓</td><td>✓</td><td>✓</td><td>✓</td><td>✓</td><td>✓</td><td>✓</td></tr>
<tr><td>(2) Examination</td><td>60</td><td>✓</td><td>✓</td><td>✓</td><td>✓</td><td>✓</td><td>✓</td><td>✓</td></tr>
<tr><td>Total</td><td>100</td><td colspan="7"></td></tr>
</table>

Continuous assessment including assignments, laboratory exercises, quizzes and test. The continuous assessment is designed to monitor the study progress of the student. They also serve to provide student with a mechanism of self-evaluation of learning achievement. The final written examination will be used to assess the knowledge acquired by the students; as well as to determine the level of attainment of the prescribed learning outcomes.

</td></tr>
<tr><td>Student Study Effort Expected</td><td>

<table>
<tr><td>Class contact:</td><td></td></tr>
<tr><td>• Lecture</td><td>26 h</td></tr>
<tr><td>• Laboratory</td><td>24 h</td></tr>
<tr><td>Other student study effort:</td><td></td></tr>
<tr><td>• Self-study</td><td>70 h</td></tr>
<tr><td>Total student study effort</td><td>120 h</td></tr>
</table>

</td></tr>
<tr><td>Reading List and References</td><td>

Eugene Hecht, "Optics", 4th Edition, Pearson Addison Wesley.

Robert E. Fischer, "Optical System Design", 2nd Edition, McGraw-Hill 2008.

D. Malacara and Z. Malacara, "Handbook of Optical Design", Marcel Dekker, Inc, 2004.

M.J. Kidger, "Fundamental Optical Design", SPIE Press, 2002.

Optical design software used: Zemax SE

</td></tr>
</table>

Subject Description Form

Subject Code	AP30009
Subject Title	Laser Principles and Applications
Credit Value	3
Level	3
Pre-requisite/ Co-requisite/ Exclusion	Nil
Objectives	The course introduces various lasers, CW, Q-switched, tunable and mode locked lasers with emphasis on working principles, laser design and also laser applications. The course features a natural and logical blend of theory and engineering.
Intended Learning Outcomes	Upon the completion of the subject, students will be able to: (a) describe the operation principles of CW, Q-switched, mode locked, tunable lasers, lineshape broadening, laser rate equations for three level and four level laser systems, the difference between spontaneous and stimulated emission, coherent and incoherent radiation, longitudinal mode and transverse mode; (b) relate the population inversion and optical feedback to laser technology/ implementation; (c) apply the optical ray transfer matrix to determine the stability of a laser resonator; (d) describe the coherent properties and high brightness of laser, and how these laser properties related to their applications, and apply laser selection criteria for selecting suitable laser specific applications; and (e) apply the knowledge of lasers to solve some real life problems.
Subject Synopsis/ Indicative Syllabus	**Laser principles of CW laser**: three level and four level lasers system, wavelength line-shape broadening, coherence of radiation, stimulated emission, laser gain media, laser rate equations, techniques of pumping, laser resonator, longitudinal mode and transverse mode. **Laser principles of pulsed laser**: Q-switched and mode locked lasers. **Study design of various types of laser systems**: ultra-fast lasers, gas discharge lasers, diode pumped solid state lasers, semiconductor lasers, tunable dye lasers. **Laser characterization**: beam quality, divergence, pulse width, repetition rates, intensity, wavelengths FWHM, Gaussian optics and mode matching, laser safety, laser light coupling. **Laser safety and hazards**: interaction of light with matter, molecular energy levels, absorption, stimulated and spontaneous emission, scattering, laser selection criteria for specific applications. **Examples of laser applications**: laser for material processing, laser based sensing or imaging. Laser for medical applications: laser surgery, laser for scientific applications, e.g. absorption spectroscopy; laser tweezers, etc. Military: laser guided missile, eye-targeted lasers, target designator.

Teaching/Learning Methodology

Lecture: The course contents will be introduced and discussed in lectures. An active participation in these learning activities can significantly enhance students' conceptual understanding, knowledge acquisition and problem-solving skills.

Student-centered Tutorial: Tutorial classes allow students to ask questions related to abstract and difficult learning content, followed by in-depth explanation and discussion, resulting in fostering their skills in analytical power, concept acquisition, critical thinking, problem-solving and life-long learning.

Assessment Methods in Alignment with Intended Learning Outcomes

Specific assessment methods/tasks	% weighting	Intended subject learning outcomes to be assessed (Please tick as appropriate)				
		a	b	c	d	e
(1) Continuous assessment	40	✓	✓	✓	✓	✓
(2) Examination	60	✓	✓	✓	✓	✓
Total	100					

Continuous assessment:
The continuous assessment includes assignments, quizzes and test(s) which aim at checking the progress of students study throughout the course, assisting them in fulfilling the learning outcomes.
Assignments in general include end-of-chapter problems, which are used to reinforce and assess the concepts and skills acquired by the students; and to let them know the level of understanding that they are expected to reach.
At least one test would be administered during the course of the subject as a means of timely checking of learning progress by referring to the intended outcomes, and as means of checking how effective the students digest and consolidate the materials taught in the class.

Examination: This is a major assessment component of the subject. It would be a closed-book examination.

Student Study Effort Expected

Class contact:	
• Lecture	33 h
• Tutorial	6 h
Other student study effort:	
• Self-study	81 h
Total student study effort	120 h

Reading List and References

Walter Koechner, "Solid-State Laser Engineering", 6th Edition, Springer Berlin/ Heidelberg, 2010.

Gennady G. Gladush, "Physics of Laser Materials Processing: Theory and Experiment", 1st Edition, Springer, 2011.

R. Henderson and K. Schulmeister, "Laser Safety: For Users and Manufacturers of Laser Equipment", 2nd Edition, Taylor & Francis, 2011.

Subject Description Form

Subject Code	AP30011
Subject Title	Solid State Physics
Credit Value	3
Level	3
Pre-requisite/ Co-requisite/ Exclusion	Nil
Objectives	The objectives of this subject are to provide the fundamental knowledge of crystal structures; and an introduction of the theories for describing the physical phenomena associated with bonding; X-ray diffraction, lattice vibration and related thermal properties; electronic transport properties and magnetic properties of solids.
Intended Learning Outcomes	Upon completion of the subject, students will be able to: (a) describe crystal structure based on the concepts of lattice, basis, unit cell and reciprocal space; (b) describe covalent bond, ionic bond, metallic bonding and van der Waals bonding in solids; (c) interpret x-ray diffraction data for identifying a crystal structure; (d) describe crystal vibration, sound speed and density of vibrational modes, acoustic and optical branches, Brillouin zone, temperature dependence of specific heat capacity and thermal conductivity of crystals; (e) apply Bloch's theory to describe the wave functions of electrons in a crystal, tight-binding approximation to explain the formation of electron bands, and derive the effective mass of a charge carrier in a crystal; (f) describe density of electron states, and specific heat capacity due to conduction electrons in a metal; and (g) identify various magnetisms of a crystal, including paramagnetism and ferromagnetism.
Subject Synopsis/ Indicative Syllabus	**Crystal structure**: lattice and basis; lattice vectors; unit cell; crystal symmetry; Bravais lattice systems; lattice plane and Miller indices; reciprocal lattice space; lattice spacing. **Bonding in solids**: covalent bond; ionic bond; metallic bonding and van der Waals bonding. **X-ray diffraction**: formulation of the intensity of diffracted x-ray beam from a crystal; atomic form factor and structure factor; determination of crystal structure. **Lattice vibration and phonon**: vibration of monatomic and diatomic linear chains; Brillouin zone; density of vibrational modes; phonon; Einstein and Debye models; heat capacity and thermal conductivity of crystals. **Electron states**: Bloch Theorem; reduced zone scheme; nearly free electron model; tight-binding model; formation of electron bands; Fermi surface, specific heat capacity due to conduction electrons. **Magnetism**: g-factor; paramagnetism; ferromagnetism, Curie temperature, ferromagnetic domains; magnetic resonance.

Teaching/Learning Methodology

Lecture: Delivery of lectures interactively to enable students to participate actively in acquiring knowledge, and to raise questions and discuss for clarifying their doubts generated in their learning process. Examples in relation to real life and engineering practices are given to enable the student to alert applications of the subject contents to real life problems.

Tutorial: To be run in small groups for the students to consolidate the contents of lectures. Students are properly guided to participate actively in solving problems, raising questions and discussion.

e-learning: Electronic means and multimedia technologies would be adopted for presentations of lectures; communication between students and lecturer; delivery of handouts, homework and notices etc. in order to enhance the effectiveness of teaching and learning processes.

Assessment Methods in Alignment with Intended Learning Outcomes

Specific assessment methods/tasks	% weighting	Intended subject learning outcomes to be assessed (Please tick as appropriate)						
		a	b	c	d	e	f	g
(1) Continuous assessment	40	✓	✓	✓	✓	✓	✓	✓
(2) Examination	60	✓	✓	✓	✓	✓	✓	✓
Total	100							

Continuous assessment: Assignments in general include end-of-chapter problems, which are used to reinforce and assess the concepts and skills acquired by the students; and to let them know the level of understanding that they are expected to reach.
At least one test would be administered during the course of the subject as a means of timely checking of learning progress by referring to the intended outcomes, and as means of checking how effective the students digest and consolidate the materials taught in the class.

Examination: This is a major assessment component of the subject. It would be a closed-book examination. Complicated formulas would be given to avoid rote memory, such that the emphasis of assessment would be put on testing the understanding, analysis and problem solving ability of the students.

Student Study Effort Expected

Class contact:	
• Lecture	33 h
• Tutorial	6 h
Other student study effort:	
Self-study	81 h
Total student effort:	120 h

Reading List and References

R. Asokamani**.** Tunbridge Wells: Anshan, "Solid State Physics: Principles and Applications", New Delhi: Anamaya Pub., 2007.

Charles Kittel, "Introduction to Solid State Physics", New York: J. Wiley, 2005.

Subject Description Form

Subject Code	AP30012
Subject Title	Thermal and Statistical Physics
Credit Value	3
Level	3
Pre-requisite/ Co-requisite/ Exclusion	AP20006
Objectives	The objectives of this subject are to provide a basic understanding of the thermodynamic laws and their statistical nature. The application of the thermal and statistical physics to some physical systems will also be addressed. Key issues such as entropy, enthalpy, the second law of thermodynamics, heat engines and related items to entropy will be provided to the first part of "Thermodynamics"; whereas Boltzmann distribution, partition function, Fermi-Dirac and Bose-Einstein distribution, free electron model of metals, Fermi energy; Bose-Einstein condensation will be emphasized on the second part of the lecture: "Statistical Physics". The first part and second part will be bridged via Boltzmann equation so as to let students understand on the macroscopic and microscopic scale the meaning of entropy.
Intended Learning Outcomes	Upon completion of the subject, students will be able to: (a) understand the meaning of entropy, enthalpy and related concepts, and understand the definition of various systems such as open system, closed system and isolated system; (b) clearly grasp the meaning of the "zero, first, second and third law of thermodynamics; (c) know how to deduct the expression of entropy using Carnot heat engine efficiency and Carnot theorem; (d) describe the Boltzmann relationship of entropy and microstate of a system; (e) figure out the fundamentals of statistical mechanics, statistical weight, equilibrium of an isolated system and a system in a heat bath; (f) grasp the definition of Boltzmann distribution, partition function.; (g) describe the meaning of classical gas, Maxwell velocity distribution, and equipartition of energy; (h) know systems with variable particle numbers including Fermi-Dirac and Bose-Einstein distributions; and (i) understand free electron model of metals, Fermi energy; Bose gas, and Bose-Einstein condensation.
Subject Synopsis/ Indicative Syllabus	**The first law of thermodynamics**: fundamental thermal concepts; enthalpy; flow processes. **The second law of thermodynamics**: statements of the second law; heat engines and refrigerators; Clausius theorem; entropy of a system. **Thermodynamic potentials and applications to simple thermodynamic systems**: thermodynamic potentials; thermodynamic equations; perfect gases; real gases; elastic rods; magnetic systems. **Phase equilibrium and phase transition**: equilibrium conditions; Clausius-Clapeyron equation; critical point; first and second-order phase transitions.

Fundamentals of statistical mechanics: statistical weight; equilibrium of an isolated system and a system in a heat bath; Boltzmann distribution; partition function.

The perfect classical and quantal gas: partition function of a perfect classical gas; Maxwell velocity distribution, equipartition of energy; quantum statistics.

Systems with variable particle numbers: Gibbs distribution; Fermi-Dirac and Bose-Einstein distribution; free electron model of metals; Fermi energy; Bose gas, Bose-Einstein condensation.

Teaching/Learning Methodology

Lecture: To instruct students with related mathematical background for calculation and deduction of related equation and theorems involved in thermodynamics and statistical physics.

Tutorial: To deliver intensified practical questions and quizzes so as to enable students to grasp and apply the basic concepts, definitions, theorems, equations and formulas in both thermodynamics and statistical physics.

Assessment Methods in Alignment with Intended Learning Outcomes

Specific assessment methods/tasks	% weighting	Intended subject learning outcomes to be assessed (Please tick as appropriate)								
		a	b	c	d	e	f	g	h	i
(1) Continuous assessment	40	✓	✓	✓	✓	✓	✓	✓	✓	✓
(2) Examination	60	✓	✓	✓	✓	✓	✓	✓	✓	✓
Total	100									

Continuous assessment: Assignments in general include end-of-chapter problems, which are used to reinforce and assess the concepts and skills acquired by the students; and to let them know the level of understanding that they are expected to reach.
At least one test would be administered during the course of the subject as a means of timely checking of learning progress by referring to the intended outcomes, and as means of checking how effective the students digest and consolidate the materials taught in the class.

Examination: This is a major assessment component of the subject. It would be a closed-book examination. Complicated formulas would be given to avoid rote memory, such that the emphasis of assessment would be put on testing the understanding, analysis and problem solving ability of the students.

Student Study Effort Expected

Class contact:	
• Lecture	33 h
• Tutorial	6 h
Other student study effort:	
• Self-study	81 h
Total student study effort	120 h

Reading List and References	R. Asokamani**.** Tunbridge Wells: Anshan, "Solid State Physics: Principles and Applications", New Delhi: Anamaya Pub., 2007. Charles Kittel, "Introduction to Solid State Physics", New York: J. Wiley, 2005.

Subject Description Form

Subject Code	AP30013
Subject Title	Photonics Laboratory
Credit Value	3
Level	3
Pre-requisite/ Co-requisite/ Exclusion	Nil
Objectives	This subject will provide the fundamental concepts of optics and photonics and experimental optical alignments and measurements. Data treatment and analyzing skills are also included.
Intended Learning Outcomes	Upon completion of the subject, students will be able to: (a) analyze experimental data by least-squares fit method by using computer software. (b) describe results by a written report containing tabulation of data and graphical illustrations; (c) understand the working principle of some optics and photonics components; (d) use equipment to measure optical properties, refractive index, Brewster's angle etc. of some optical materials; (e) apply knowledge and experimental skills to solve some practical problem in the field of photonics; and (f) use equipment to characterize LED power, emission spectrum, colors.
Subject Synopsis/ Indicative Syllabus	Reflection; refraction and total internal reflection of light; Snell's law. Lens equations; the basic principle of projector and magnifier; skills of handling optics and optical alignments. Understanding the perception of human eyes to size and color. Color and polarization of light; polarization of light; Brewster's angle; polarizer; color filters. Telescope and microscope; double-slit interference and single-slit diffraction; cleaning of the optics; skills of handling optics and optical alignments. Understanding and using the optoelectronic experimental setups to characterize blackbody radiation; incandescent light sources; LED; and white light sources.
Teaching/Learning Methodology	The data process methods and the principles of the lab experiments are introduced in lecture courses in parallel with the lab classes. This would help the students to develop better understandings of the physical principles and to build up their capability to write high-quality experimental reports. The working principles of the lab equipment are presented in the lab manuals and the key points and precautions are highlighted at the beginning of the lab classes. During the laboratory classes, the technician and the tutors assist the students to solve unexpected problems and lead them through the difficult parts. In addition, a presentation session is arranged for students to form groups to present on any topics related to the labs. This encourages the students to go for in-depth self study, broadens their knowledge and improves their communication skills in technical discussions.

Assessment Methods in Alignment with Intended Learning Outcomes

Specific assessment methods/tasks	% weighting	Intended subject learning outcomes to be assessed (Please tick as appropriate)					
		a	b	c	d	e	f
(1) Continuous assessment	40	✓	✓	✓	✓	✓	✓
(2) Practical examination	20	✓	✓	✓	✓	✓	✓
(3) Written test	40	✓	✓	✓	✓	✓	✓
Total	100						

Students are expected to excel in physical understanding and practical operation. The continuous assessment includes the lab reports and log books. Written test and practical examination can evaluate the capabilities of the students in problem solving and practical operation.

Student Study Effort Expected

Class contact:	
• Lecture	13 h
• Laboratory	39 h
Other student study effort:	
• Laboratory report preparation	36 h
• Laboratory manual reading, assignment preparation and lecture notes review	32 h
Total student study effort	120 h

Reading List and References

Eugene Hecht, “Optics”, 4th Edition, Addison Wesley, 2002.

Subject Description Form

Subject Code	AP30014
Subject Title	Science and Technology of Photovoltaics
Credit Value	3
Level	3
Pre-requisite/ Co-requisite/ Exclusion	Nil
Objectives	The objective of this course is to study the operation principles, device structures, fabrication technologies and characterizations of various types of solar cells, and photovoltaic system engineering.
Intended Learning Outcomes	Upon completion of the subject, students will be able to: (a) understand the nature of solar radiation and the energy input to a photovoltaic system; (b) apply the fundamental physics to explain the operation principle of single-junction solar cells, and understand the materials properties and device structures are critical to photovoltaics; (c) identify the technological steps which are used in the manufacture of solar cells; (d) evaluate the performance of photovoltaic devices by using their characteristics, including current-voltage (I-V) and spectral response curves. (e) acknowledge the principles, fabrication and performances of various types of advanced solar cells, including thin-film and tandem cells, dye-sensitized cells, nanostructured cells, organic photovoltaics, and thermo photovoltaic devices. (f) acknowledge solar module, solar photovoltaic system, and power conditioning and control.
Subject Synopsis/ Indicative Syllabus	**Solar radiation and electricity from sun**: energy from the sun; solar spectrum; air mass AM0 and AM1.5; sun simulator; history and status of photovoltaics. **Principles of a p-n junction solar cell**: semiconductor basics; light absorption; I-V characteristics; operation principle; equivalent circuit of solar cell; performance parameters (V_{oc}, I_{sc}, FF, η) and spectral response. **Solar cell design and fabrication**: power loss; limitations on energy conversion; managing light; optimization of Si solar cell design; alternatives to silicon (GaAs, etc.); fabrication process. **Advanced photovoltaic devices**: thin-film and tandem solar cell technologies; dye-sensitized cells; nanostructured cells; organic photovoltaics; and thermo photovoltaic devices. **Photovoltaic modules and system**: solar module and arrays; energy storage systems; DC/DC and DC/AC converters; charge controller; operation of solar photovoltaic system.
Teaching/Learning Methodology	**Lecture**: The concepts, fundamentals and technologies of solar cells will be explained. Delivery of lectures interactively to enable students to participate actively in acquiring knowledge. Students are encouraged to solve problems and to use their own knowledge to verify their solutions. **Tutorial**: A set of problems and group discussion topics will be arranged in the tutorial

<table>
<tr><td></td><td>classes. Students are encouraged to solve problems before before seeking assistance and having solutions.

Laboratory: Laboratory/demonstration will be provided. Students will have the opportunity to apply the knowledge gained from the lecture into practical test and applications.</td></tr>
<tr><td>Assessment Methods in Alignment with Intended Learning Outcomes</td><td>
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<tr><td>(1) Continuous assessment</td><td>40</td><td>✓</td><td>✓</td><td>✓</td><td>✓</td><td>✓</td><td>✓</td></tr>
<tr><td>(2) Examination</td><td>60</td><td>✓</td><td>✓</td><td>✓</td><td>✓</td><td>✓</td><td>✓</td></tr>
<tr><td>Total</td><td>100</td><td colspan="6"></td></tr>
</table>

Continuous assessment consists of assignments, laboratory reports and mid-term test. The continuous assessment will assess the students' understanding of basic concepts, principles and applications. Examination will be conducted to make a comprehensive assessment of students' intended learning outcomes as stated above.</td></tr>
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<tr><td>Total student study effort</td><td>120 h</td></tr>
</table>
</td></tr>
<tr><td>Reading List and References</td><td>P. Jayarama Reddy, "Science and Technology of Photovoltaics", 2nd Edition, CRC Press, (2010).
Martin A. Green, "Third Generation Photovoltaics: Advanced Solar Energy Conversion", SpringerLink e-books, (2006).
Peter Würfel, "Physics of Solar Cells: From Principles to New Concepts", Wiley-VCH (2005).</td></tr>
</table>

Subject Description Form

Subject Code	AP40002
Subject Title	Display Technology
Credit Value	3
Level	4
Pre-requisite/ Co-requisite/ Exclusion	Nil
Objectives	The aim of this subject is to provide a fundamental understanding of the physics and operation principles of both inorganic and organic display materials and devices, and to illustrate the application and fabrication of various types of display technology.
Intended Learning Outcomes	Upon completion of the subject, students will be able to: (a) describe the human visual system and apply display specification to understand the characteristics of display systems; (b) apply the theory of energy transfer to elucidate the optical emission and describe different types of luminescence in display phosphors; (c) explain the operation principles and fabrications of various inorganic display devices; analyze advantages and disadvantages of various display panel; (d) describe the different phases and optical properties of liquid crystal materials; explain the working principles of twisted nematic cell used in displays; (e) describe the structure of thin film transistors (TFT) and formulate the TFT characteristics; (f) explain the operating principles of active matrix liquid crystal displays (AMLCD) and the addressing methods of pixels; describe the fabrication process of AMLCD; (g) describe the structure and the working principles of organic light emission diodes (OLED) and display; and (h) differentiate various modern display technologies and elaborate on their advantages and disadvantages.
Subject Synopsis/ Indicative Syllabus	**Fundamentals of display technology**: human vision and perception for display; Red-Blue-Green (RGB) color gamut; chromaticity; energy transfer; energy absorption**;** optical emission; photoluminescence (PL); cathodoluminescence (CL) and electroluminescence (EL); phosphors. **Inorganic display technology**: cathode-ray tube (CRT) display; flat-panel display; field emission display (FED); plasma display panel (PDP); semiconductor light-emitting diode (LED) display; microdisplay and others. **Display measurements**: photometric and colorimetric measurements; display measurement system. **Liquid crystal**: isotropic; nematic and smectic phases; twisted nematic cell. **Thin film transistors (TFT)**: device structure and performance; amorphous silicon TFT; polycrystalline silicon TFT; organic TFT.

<table>
<tr><td></td><td>Active matrix liquid crystal display (AMLCD): structure of AMLCD; drive circuit; addressing method; fabrication of AMLCD.

Organic light emission diode (OLED): organic semiconductor; device structure and performance; OLED display.</td></tr>
<tr><td>Teaching/Learning Methodology</td><td>Lecture: the fundamentals of display physics and various display technologies will be described. The students are free to request help. The students are encouraged to solve problems and to use their own knowledge to verify their solutions before seeking assistance.

Tutorial: a set of problems and group discussion topics will be arranged in the tutorial classes. Students are encouraged to solve problems before having solutions.

Laboratory: a set of laboratories/demonstrations will provide students opportunities to apply the fundamental knowledge gained from the lecture into display technologies and hence develop a deeper understanding of the subject.</td></tr>
<tr><td>Assessment Methods in Alignment with Intended Learning Outcomes
(Note 4)</td><td>
<table>
<tr><td rowspan="2">Specific assessment methods/tasks</td><td rowspan="2">% weighting</td><td colspan="8">Intended subject learning outcomes to be assessed
(Please tick as appropriate)</td></tr>
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<tr><td>(1) Continuous assessment</td><td>40</td><td>✓</td><td>✓</td><td>✓</td><td>✓</td><td>✓</td><td>✓</td><td>✓</td><td>✓</td></tr>
<tr><td>(2) Examination</td><td>60</td><td>✓</td><td>✓</td><td>✓</td><td>✓</td><td>✓</td><td>✓</td><td>✓</td><td>✓</td></tr>
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</table>

Continuous assessment consists of assignments, laboratory reports and mid-term test. The continuous assessment will assess the students’ understanding of basic concepts and principles in materials science. Examination will be conducted to make a comprehensive assessment of students’ intended learning outcomes as stated above.</td></tr>
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<tr><td>Total student study effort</td><td>120 h</td></tr>
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</td></tr>
</table>

Reading List and References	Jiun-Haw Lee, David N. Liu and Shin-Tson Wu, "Introduction to Flat Panel Displays", John Wiley & Sons Ltd., 2008. Ernst Lueder, "Liquid Crystal Displays: Addressing Schemes and Electro-Optical Effects", 2nd Edition, Wiley (2010). Robert L. Myers, "Display Interfaces: Fundamentals and Standards", John Wiley & Sons Ltd., 2002. Hari Singh Nalwa and Lauren Shea Rohwer Edition, "Handbook of Luminescence, Display Materials, and Devices", American Scientific Publishers, 2003.

Subject Description Form

Subject Code	AP40003
Subject Title	Solid State Lighting
Credit Value	3
Level	4
Pre-requisite/ Co-requisite/ Exclusion	Nil
Objectives	Solid-state lighting (SSL) has revolutionized the lighting industry. Light-emitting diodes (LEDs)—traditionally used in signs, signals and displays—are rapidly evolving to provide light sources for general illumination. The objective of this course is studied all aspects of the technology and physics of light-emitting diodes for the applications in solid-state lighting.
Intended Learning Outcomes	Upon completion of the subject, students will be able to: (a) acknowledge the historical developments and milestones of SSL research and development; (b) understand all aspects of the technology and physics of white- LEDs made from III-V semiconductors; (c) identify elementary properties of LEDs such as the electrical and optical characteristics; (d) understand the advanced LEDs physics including high-efficiency device designs, light extraction, radiative and non-radiative recombination dynamics, spontaneous recombination in resonant-cavity structures; and (e) understand the industry and users' perspectives for LEDs and SSL.
Subject Synopsis/ Indicative Syllabus	(1) Principles of operation of LEDs. (2) Heterostructure materials systems, chip design and characteristics of LEDs. (3) Light extraction, solid-state sources of white light. (4) Nonvisual and visual applications of SSL.
Teaching/Learning Methodology	**Lecture:** Delivery of lectures interactively to enable students to participate actively in acquiring knowledge, and to raise questions and discuss for clarifying their doubts generated in their learning process. **Tutorial**: For the students to consolidate the contents of lectures. Students are properly guided to participate actively in solving problems, raising questions and discussion.

Assessment Methods in Alignment with Intended Learning Outcomes

Specific assessment methods/tasks	% weighting	Intended subject learning outcomes to be assessed (Please tick as appropriate)				
		a	b	c	d	e
(1) Continuous assessment	40	✓	✓	✓	✓	✓
(2) Examination	60	✓	✓	✓	✓	✓
Total	100					

Continuous assessment: Assignments in general include end-of-chapter problems, which are used to reinforce and assess the concepts and skills acquired by the students; and to let them know the level of understanding that they are expected to reach.
At least one test would be administered during the course of the subject as a means of timely checking of learning progress by referring to the intended outcomes, and as means of checking how effective the students digest and consolidate the materials taught in the class.

Examination: This is a major assessment component of the subject. It would be a closed-book examination. Complicated formulas would be given to avoid rote memory, such that the emphasis of assessment would be put on testing the understanding, analysis and problem solving ability of the students.

Student Study Effort Expected

Class contact:	
• Lecture	33 h
• Tutorial	6 h
Other student study effort:	
▪ Self-study	81 h
Total student study effort	120 h

Reading List and References

E.F. Schubert, "Light-Emitting Diodes", Cambridge, 2006.

A. Žukauskas, M.S. Shur and R. Gaska, "Introduction to Solid-State Lighting", Wiley, New York, 2002.

S. Winder S., "Power Supplies for LED Driving", Newnes, Amsterdam, 2008.

G. Held, "Introduction to Light-Emitting Diode Technology and Applications", Taylor & Francis, Boca Raton, 2009.

Subject Description Form

Subject Code	AP40004
Subject Title	Project
Credit Value	4
Level	4
Pre-requisite/ Co-requisite/ Exclusion	Nil
Objectives	Projects are designed to reveal two main aspects of a student's ability: initiative in organizing and following through an investigation, and ability for critical assessment of information. In the course of doing his/her project, the student also acquires an in-depth knowledge of a certain topic in applied physics, materials science/technology, electrical or electronic engineering.
Intended Learning Outcomes	Upon completion of the subject, students will be able to: (a) plan and successfully complete a project; (b) integrate and apply the theoretical knowledge and experimental techniques learned from different subject areas to carry out the project; (c) compile, organize, and present results in an appropriate format; (d) assess and interpret the results obtained, and draw conclusions thereupon; (e) recognize the limitations of the project and make suggestions for further work; (f) work independently in making plans and judgments; (g) be able to analyze, evaluate, synthesize and propose solutions to problems of a general nature, with innovative/creative ideas where appropriate; (h) be able to communicate clearly and effectively in English; (i) be able to demonstrate a sense of responsibility and accountability; and (j) be able to search relevant information from different sources, especially from the web, and to make correct judgment in using such information;
Subject Synopsis/ Indicative Syllabus	Depend on the design and requirements of individual project.
Teaching/Learning Methodology	This is a 4-credit student project which spans over the final year of the programme. Students need to give mid-term presentations, and end-of-year presentations, and to submit reports. Students are encouraged to explore any new ideas with greatest degree of freedom, and to implement the ideas creatively under the guidance of their supervisors.

Assessment Methods in Alignment with Intended Learning Outcomes

Specific assessment methods/tasks	% weighting	Intended subject learning outcomes to be assessed (Please tick as appropriate)									
		a	b	c	d	e	f	g	h	i	j
(1) Continuous assessment	30	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓
(2) Project report	40	✓	✓	✓	✓	✓		✓	✓	✓	✓
(3) Oral (Mid-term)	15			✓	✓				✓		
(4) Oral (Final)	15			✓	✓				✓		
Total	100										

Project learning provides an opportunity for students to actively participate in solving problems in a self-managed and self-directed manner whereby they have to apply their knowledge to a specific problem, to analyze and integrate, to interpret and judge, to communicate and to report, thus covering the intended outcomes listed above.

Student Study Effort Expected

• Project work	78 h
• Self-study	82 h
Total student study effort	160 h

Reading List and References

According to the guidance from the supervisors.

Subject Description Form

Subject Code	AP40005
Subject Title	Optoelectronic Packaging and Reliability
Credit Value	3
Level	4
Pre-requisite/ Co-requisite/ Exclusion	Nil
Objectives	The aim of this subject is to provide students with an understanding of reliability requirements, testing techniques, packaging and assembly processes of optoelectronic materials, devices and systems.
Intended Learning Outcomes	Upon completion of the subject, students will be able to: (a) explain basic reliability physics and engineering of basic devices; (b) apply the fundamentals of optics to describe the laser diode-to-fiber coupling and fiber-to-fiber coupling in optoelectronic packaging; (c) explain the origins and remedial actions of various packaging-related reliability mechanisms; (d) describe the structure, principles of operation, fabrication, possible defects and contaminations related to the reliability and packaging issues of basic optoelectronic devices; (e) explain the principles and limitations of different microscopic/analytical techniques for the device diagnosis before and after the package is opened; (f) perform optical, electrical, thermal, mechanical and environmental analysis on the reliability and packaging of lasers, optical fibers and optical components; (g) analyze high-power light-emitting diodes (LEDs) packaging as well as the requirements and approaches to determine LEDs performance and reliability; and (h) describe design type, package requirements, process and assembly conditions of various optoelectronic devices and arrays.
Subject Synopsis/ Indicative Syllabus	**Overview of optoelectronic packaging**: development flow of devices fabrication; packaging functions of light sources; optical waveguides and detectors; optoelectronic vs. electronic packaging. **Fundamentals of reliability**: mathematical models of the characteristic curve; accelerated testing; time-to-failure modeling; failure analysis. **Package-related reliability mechanisms**: corrosion, electromigration; solder fatigue; spiking effect; die attachment failure; stress-voiding; defects and contaminations; electrically-induced damage. **Techniques for materials characterization**: materials for optoelectronic packaging; techniques prior to the package opening**;** package opening techniques; microscopic techniques; analytical techniques. **Reliability of optoelectronic devices**: reliability testing of lasers and LEDs; microscopic mechanisms of laser damage; contacts and bonding reliability; optical fiber strength; static fatigue of fiber; environmental degradation of optical fiber.

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Methods for optoelectronic packaging: thermal; mechanical and electrical design considerations; optical alignment; technologies for optoelectronic packaging.

Packaging of light sources: light extraction; encapsulation and protection; laser die bonding; high-power LEDs packaging.

Packaging of optical waveguide and detectors: couple laser to fiber**;** pigtail fiber to detector; transceiver packages; optical interconnects.

</td></tr>
<tr><td>Teaching/Learning Methodology</td><td>

Lecture: The fundamentals of reliability and packaging of various optoelectronic devices will be described. Students are free to request help. Students are encouraged to solve problems and to use their own knowledge to verify their solutions before seeking assistance.

Tutorial: A set of problems and group discussion topics will be arranged in the tutorial classes. Students are encouraged to solve problems before having solutions.

Laboratory: A set of laboratories /demonstrations will be provided. Students will have the opportunity to apply the fundamental knowledge gained from the lecture into practical materials test and device applications and hence develop a deeper understanding of the subject.

</td></tr>
<tr><td>Assessment Methods in Alignment with Intended Learning Outcomes</td><td>

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<tr><td>(2) Examination</td><td>60</td><td>✓</td><td>✓</td><td>✓</td><td>✓</td><td>✓</td><td>✓</td><td>✓</td><td>✓</td></tr>
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</table>

Continuous assessment consists of assignments, laboratory reports and mid-term test. The continuous assessment will assess the students' understanding of basic concepts and principles in materials science. Examination will be conducted to make a comprehensive assessment of students' intended learning outcomes as stated above.

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</table>

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<tr><td>Reading List and References</td><td>

Robert W. Herrick, "Failure Analysis and Reliability of Optoelectronic Devices", 2004.

Richard K. Ulrich and William D. Brown, "Advanced Electronic Packaging", John Wiley & Sons, Inc., 2006.

D. Lu and C.P. Wong, "Materials for Advanced Packaging", Springer (2009).

</td></tr>
</table>

Subject Description Form

Subject Code	AP40006
Subject Title	Semiconductor Materials and Devices
Credit Value	3
Level	4
Pre-requisite/ Co-requisite/ Exclusion	Nil
Objectives	The aim of the subject is to provide the students with an understanding of semiconductor physics, semiconductor materials properties and operation of various types of semiconductor junction diodes and transistors.
Intended Learning Outcomes	Upon completion of the subject, students will be able to: (a) apply band theory to explain the behaviors of intrinsic and extrinsic semiconductors at different temperatures; (b) explain nonequibrium with excess carriers, and solve problems of the quasi-Fermi level splitting; (c) solve problems in one-dimensional transport of carriers in drift (including Hall effect) and in diffusion; (d) explain the behaviors of pn junctions under bias, and solve problems on the design of pn junctions; (e) apply the theory of semiconductors to explain the functions of various semiconductor devices, such as switching diodes, breakdown diodes, solar cells, photodiodes and photodetectors, light-emitting diodes, etc.; and (f) explain charge transport in semiconductor transistors and I-V characteristics.
Subject Synopsis/ Indicative Syllabus	**Semiconductor materials and growth**: structure and physical properties of semiconductor materials; crystal and epitaxial growth, energy bands **Charge carriers in semiconductors**: electrons and holes; intrinsic and extrinsic semiconductors; Fermi level; carrier concentrations; drift; mobility and conductivity; Hall effect. **Excess carriers**: optical absorption; luminescence; recombination and carrier lifetime; quasi-Fermi levels; photoconductivity; diffusion; steady-state carrier injection; diffusion length. **p-n junctions and diodes**: fabrication; contact potential; space charge and depletion layer; biased junction and diode equation; reverse-bias breakdown; capacitance of p-n junctions; metal-semiconductor junctions; switching diodes; varactor diodes; tunnel diodes; solar cells; photodetectors; light-emitting diodes. **Transistors**: charge transport in a bipolar junction transistor (BJT) and field-effect transistor (FET); I-V characteristics; amplification; switching using transitors; integrated circuit (IC) technology.

<table>
<tr><td>Teaching/Learning Methodology</td><td>

Lecture: The fundamentals of semiconductor physics, materials and various devices will be described. Students are free to request help. Students are encouraged to solve problems and to use their own knowledge to verify their solutions before seeking assistance.

Tutorial: A set of problems and group discussion topics will be arranged in the tutorial classes. Students are encouraged to solve problems before having solutions.

Laboratory: A set of laboratories /demonstrations will be provided. Students will have the opportunity to apply the fundamental knowledge gained from the lecture into practical materials test and device applications and hence develop a deeper understanding of the subject.

</td></tr>
<tr><td>Assessment Methods in Alignment with Intended Learning Outcomes</td><td>

<table>
<tr><td rowspan="2">Specific assessment methods/tasks</td><td rowspan="2">% weighting</td><td colspan="6">Intended subject learning outcomes to be assessed (Please tick as appropriate)</td></tr>
<tr><td>a</td><td>b</td><td>c</td><td>d</td><td>e</td><td>f</td></tr>
<tr><td>(1) Continuous assessment</td><td>40</td><td>✓</td><td>✓</td><td>✓</td><td>✓</td><td>✓</td><td>✓</td></tr>
<tr><td>(2) Examination</td><td>60</td><td>✓</td><td>✓</td><td>✓</td><td>✓</td><td>✓</td><td>✓</td></tr>
<tr><td>Total</td><td>100</td><td colspan="6"></td></tr>
</table>

Continuous assessment consists of assignments, laboratory reports and mid-term test. The continuous assessment will assess the students' understanding of basic concepts and principles in materials science. Examination will be conducted to make a comprehensive assessment of students' intended learning outcomes as stated above.

</td></tr>
<tr><td>Student Study Effort Expected</td><td>

<table>
<tr><td>Class contact:</td><td></td></tr>
<tr><td>• Lecture</td><td>26 h</td></tr>
<tr><td>• Tutorial</td><td>6 h</td></tr>
<tr><td>• Laboratory</td><td>9 h</td></tr>
<tr><td>Other student study effort:</td><td></td></tr>
<tr><td>• Self-study</td><td>79 h</td></tr>
<tr><td>Total student study effort</td><td>120 h</td></tr>
</table>

</td></tr>
<tr><td>Reading List and References</td><td>

B.G. Streetman, "Solid State Electronic Devices", Prentice-Hall, 2006.

S.M. Sze and Kwok K. Ng, "Physics of Semiconductor Devices", 3rd Edition, John Wiley & Sons, Inc., 2007.

D.A. Neaman, "Semiconductor Physics and Devices: Basic Principles", 3rd Edition, McGraw-Hill, 2003.

</td></tr>
</table>

Subject Description Form

Subject Code	AP40009
Subject Title	Advanced Photonics Laboratory
Credit Value	3
Level	4
Pre-requisite/ Co-requisite/ Exclusion	Nil
Objectives	Students will learn some advanced experimental techniques related to laser and photonics. Principles of optical spectroscopy will be conveyed for further characterization of materials. Optics and photonics experiments will be provided to illustrate the fundamentals of modern optics, optoelectronics and their applications.
Intended Learning Outcomes	Upon completion of the subject, students will be able to: (a) manipulate some advanced instruments commonly used in the area of modern optics and photonics; (b) utilize the characteristics of a gas laser for practical applications; (c) use laser to make holograms and to measure the velocity of an object; (d) understand the working mechanism of the fibre optics based sensor; (e) measure the emission and absorption spectrum of various materials; (f) measure the energy band gap of a semiconductor; and (g) investigate the frequency doubled diode pumped solid state laser and laser cavity alignment.
Subject Synopsis/ Indicative Syllabus	**Fiber optics based sensor**: fibre interferometry; fiber Bragg grating, optical isolator; attenuator; structure and fabrication of fiber Bragg grating. Linear photodiode array; scanning Fabry-Pérot interferometer; frequency analyzer. Diode laser pumped solid state laser and frequency doubling; cavity optimizations; and laser characterization. **Laser applications**: Laser Doppler velocimetry; holography.
Teaching/Learning Methodology	The principles of the laboratory experiments are introduced in lectures in parallel with the laboratory sessions. This would help students to develop better understandings of the physical principles and to build up their capability to write high-quality experimental reports. The working principles of the equipment are presented in the laboratory manuals and the key points and precautions are highlighted at the beginning of the laboratory class. During the laboratory session, technician and teaching assistant will assist students to solve unexpected problems and lead them through the difficult parts. In addition, a presentation session will be arranged for students to form groups to present on any topics related to the experiments. This encourages students to go for in-depth self-study, broadens their knowledge and improves their communication skills in technical discussions

Assessment Methods in Alignment with Intended Learning Outcomes

Specific assessment methods/tasks	% weighting	Intended subject learning outcomes to be assessed (Please tick as appropriate)						
		a	b	c	d	e	f	g
(1) Continuous assessment	40	✓	✓	✓	✓	✓	✓	✓
(2) Practical examination	20	✓	✓	✓	✓	✓	✓	✓
(3) Written test	40	✓	✓	✓	✓	✓	✓	✓
Total	100							

Students are expected to excel in physical understanding and practical operation. The continuous assessment includes the lab reports and log books. Written test and practical examination can evaluate the capabilities of the students in problem solving and practical operation.

Student Study Effort Expected

Class contact:	
• Lecture	13 h
• Laboratory	39 h
Other student study effort:	
• Laboratory report preparation	38 h
• Laboratory manual reading, assignment preparation and lecture notes review	30 h
Total student study effort	120 h

Reading List and References

Walter Koechner, "Solid-State Laser Engineering", 6th Edition, Springer Berlin/ Heidelberg, 2010.

Yariv, A., "Optical Electronics", 4th Edition, Saunders College, 1991.

Heinz-Eberhard, A., "Laser Doppler and Phase Doppler Measurement Techniques", Springer, 2003.

Subject Description Form

Subject Code	AP40010
Subject Title	Lighting Control Technology
Credit Value	3
Level	4
Pre-requisite / Co-requisite/ Exclusion	Nil
Objectives	To introduce the basic concepts of electricity, lighting electronics and circuits as well as the technology and applications in lighting control.
Intended Learning Outcomes *(Note 1)*	Upon completion of the subject, students will be able to: (a) have a basic understanding of electricity; (b) state the basic operation principles of common lighting electronic devices; (c) design and analyze digital circuits and systems; (d) describe the principles of different lighting control components; (e) understand the fundamentals of lighting control circuits, signals and protocols; and (f) demonstrate the applications of lighting control.
Subject Synopsis/ Indicative Syllabus *(Note 2)*	**Basic electricity:** fundamental units; electrical components (resistors, capacitors and inductors); electrical distribution (direct current, alternating current, circuits and transformers); electrical control elements (switches, fuses, and circuit breakers); **Fundamentals of lighting electronics:** diodes (pn junction diode, zener diode, light emitting diode and photo diode); transistors (bipolar junction transistor (BJT), metal-oxide-semiconductor field-effect transistor (MOSFET), junction field effect transistor (JFET), insulated gate bipolar transistor (IGBT) and thyristor); amplifiers (Class A, B, C and D); analog to digital conversion; integrated circuits; microprocessor. **Design of digital circuits and systems:** MOS processing; design rules and layout design; logic functions and logic gates; memory circuits (ROM, EPROM, EEPROM, DRAM and SRAM); CMOS processing; CMOS circuits; BiCMOS circuits; digital system structures; system design techniques. **Lighting control components:** electromagnetic components (transformers for lighting, ballasts, ignitors and starters); electronic components (inverters, transformer circuits and ballast circuits). **Dimmers and control systems:** dimmer laws; dimmer circuits; standard protocols for lighting control; networks and buses; cordless control; architectural and entertainment lighting control; energy management and building control; emergency and security lighting.

<table>
<tr><td></td><td>Applications of lighting control: commercial, industrial and architectural applications; practical lighting design.</td></tr>
<tr><td>Teaching/Learning Methodology
(Note 3)</td><td>Lecture: The course materials will be explained. Concrete examples will be given to illustrate difficult concepts. Students are encouraged to ask questions and participate more in lectures. Assignment sets will be given to assess the learning progress of students.
Tutorial: Students will work on problem sets in the tutorials, which provide them opportunities to apply the knowledge gained in lectures.</td></tr>
<tr><td>Assessment Methods in Alignment with Intended Learning Outcomes
(Note 4)</td><td>
<table>
<tr><td rowspan="2">Specific assessment methods/tasks</td><td rowspan="2">% weighting</td><td colspan="6">Intended subject learning outcomes to be assessed (Please tick as appropriate)</td></tr>
<tr><td>a</td><td>b</td><td>c</td><td>d</td><td>e</td><td>f</td></tr>
<tr><td>(1) Continuous assessment</td><td>40</td><td>✓</td><td>✓</td><td>✓</td><td>✓</td><td>✓</td><td>✓</td></tr>
<tr><td>(2) Examination</td><td>60</td><td>✓</td><td>✓</td><td>✓</td><td>✓</td><td>✓</td><td>✓</td></tr>
<tr><td>Total</td><td>100</td><td>✓</td><td>✓</td><td>✓</td><td>✓</td><td>✓</td><td>✓</td></tr>
</table>
Continuous assessment includes assignments and tests which aim at checking the progress of students throughout the course, assisting them in self-monitoring their performances. The examination will be used to assess the knowledge acquired by the students, as well as to determine the extent in which they have achieved the intended learning outcomes.
</td></tr>
<tr><td>Student Study Effort Expected</td><td>
<table>
<tr><td>Class contact:</td><td></td></tr>
<tr><td>▪ Lecture</td><td>33 h</td></tr>
<tr><td>▪ Tutorial</td><td>6 h</td></tr>
<tr><td>Other student study effort:</td><td></td></tr>
<tr><td>▪ Self-study</td><td>81 h</td></tr>
<tr><td>Total student study effort</td><td>120 h</td></tr>
<tr><td></td><td></td></tr>
</table>
</td></tr>
<tr><td>Reading List and References</td><td>Robert S. Simpson, “Lighting control technology and applications”, Focal Press, 2003.

Damon Wood, “Lighting upgrades a guide for facility managers”, 2nd edition, The Fairmont Press, Inc and Marcel Dekker, Inc, 2004.

Craig DiLouie, “Lighting controls handbook”, The Fairmont Press, Inc and</td></tr>
</table>

	CRC Press, 2008. Stanley Lyons, “Emergency Lighting for industrial, commercial and residential premises”, Butterworth-Heinemann Ltd, 1992. Michael Neidle, “Emergency and Security Lighting Handbook”, Heinemann Newnes, 1988.

Subject Description Form

Subject Code	CBS2212P
Subject Title	Chinese Communication for Professionals of Applied Sciences
Credit Value	2
Level	2
Pre-requisite	Nil
Co-requisite	Nil
Exclusion	Nil
Objectives	This subject aims at fostering students' communication skills and logical thinking abilities through trainings in reading, writing and speaking for the professional contact of Applied Science.
Intended Learning Outcomes	Upon completion of the subject, students will be able to: (a) develop analytical thinking skills for better organization and presentation of ideas; (b) consolidate the essential skills for writing fluent and organized articles in Chinese for daily communication and vocational purposes; (c) acquire the oral presentation skills for effective communication; (d) acquire the necessary methods for effective reading comprehension and critical thinking that would facilitate self-learning and life-long learning.
Subject Synopsis/ Indicative Syllabus	Indicative Content: • reading strategy and comprehension of texts general and professional for communication. • structure of language and structure of ideas • logical thinking and logical writings include expository writing and argumentative writing. • organization of ideas and paragraphing letter, report, press release. • accuracy and effectiveness in oral communications, presentation of power point proposal or working plan.
Teaching/Learning Methodology	• Interactive seminars with reading and writing exercises, teaching students various instructive Chinese communication skills, group discussion, presentation drills; • Pro-class self study is required with related reading and writing exercises; • Teacher's consultation will be offered to the students depending on their individual need.

Assessment Methods in Alignment with Intended Learning Outcomes
(Note 4)

Specific assessment methods/tasks	% weighting	Intended subject learning outcomes to be assessed (Please tick as appropriate)			
		a	b	c	d
(1) Assessment 1 (Chinese composition)	15	✓	✓		✓
(2) Assessment 2 (Chinese proposal-Writing)	15	✓	✓		✓
(3) Assessment 3 (Chinese proposal-Oral presentation & discussion)	10		✓	✓	
(4) Class participation	10	✓	✓	✓	✓
(5) Examination (Writing & reading comprehension test)	50	✓	✓		✓
Total	100				

Explanation of the appropriateness of the assessment methods in assessing the intended learning outcomes:
The assessment includes criterion-referenced based quizzes, oral presentation & discussion, writing & reading comprehension test. It will evaluate students' writing communication skills, oral communication skills, pronunciation, vocabulary, colloquial expression vs. formal expression, writing and speaking achievement. The major assessment items include:

- Oral presentation & discussion (assessing accuracy, fluency and speaking in a rational & convincing way);
- Writing (assessing ability to express personal view accurately and clearly);
- Reading (assessing ability to understand the theme and gist of an article quickly).

Student Study Effort Required

Class contact:	
• Lectures & Seminars	26 h
Other student study effort:	
• outside class practice	2 x 13 = 26 h
• self-study	2 x 13 = 26 h
Total student study effort	78 h

Reading List and References

于成鯤、陳瑞端、金振邦等主編《科教文與社交文書寫作典範》，復旦大學出版社，2011
盧丹懷、何寅、謝天振編著《中港應用文傳意大全》，香港商務印書館，2002
香港城市大學語文學部編著《中文傳意基礎篇》，香港城市大學出版社，2001
香港城市大學語文學部編著《中文傳意寫作篇》，香港城市大學出版社，2001
周錫馥編著《中文應用寫作教程》，三聯書店(香港)有限公司，1996

	胡裕樹主編《大學寫作》，復旦大學出版社，1985 司有和編著《科技寫作簡明教程》，安徽教育出版社，1984 林立、尹世超編著《科技語文》，冶金工業出版社，1986 法定語文事務署《政府公文寫作手冊》，1996 曾詳芹，韓雪屏主編《閱讀學原理》河南教育出版社，1992 胡建玉編《讀書技巧》江西科學技術出版社，1991 黃葵，俞君立編著《閱讀學基礎》，武漢大學出版社，1996 陳建民《說話的藝術》，語文出版社 ，1994 李軍華《口才學》，華中理工大學出版社， 1996

Subject Description Form

Subject Code	ELC3121
Subject Title	English for Scientific Communication
Credit Value	2
Level	3
Pre-requisite	Nil
Objectives	This subject aims to develop the English language and communication skills required by students to report and discuss scientific and technical studies in a range of written texts. The subject also aims to improve and develop their English language proficiency within a framework of scientific contexts. In striving to achieve the two interrelated objectives, attention will be given to developing the core competencies identified by the University as vital to the development of effective life-long learning strategies and skills.
Intended Learning Outcomes	Upon completion of the subject, students will be able to: (a) critique and synthesise sources in scientific and technical articles and reports; and (b) report scientific information in writing to different audiences. To achieve the above outcomes, students are expected to use language and text structure appropriate to the context, select information critically, and present and support stance and opinion.
Subject Synopsis/ Indicative Syllabus	This syllabus is indicative. The balance of the components, and the corresponding weighting, will be based on the specific needs of the students. **Written reports of scientific information**: Critiquing and synthesising sources; employing appropriate language, structure and style in a range of scientific writing for a variety of audiences; maintaining cohesion and coherence in scientific texts.
Teaching/Learning Methodology	The study method is primarily seminar-based. Activities include teacher input as well as individual and group work involving drafting and evaluating texts, mini-presentations, discussions and simulations. Students will be referred to information on the Internet and the ELC's Centre for Independent Language Learning. Learning materials developed by the English Language Centre are used throughout this course. Additional reference materials will be recommended as required.

Assessment Methods in Alignment with Intended Learning Outcomes

Specific assessment methods/tasks	% weighting	Intended subject learning outcomes to be assessed (Please tick as appropriate)	
		a	b
(1) First version of two technical texts for two different audiences	60	✓	✓
(2) Final version of two technical texts for two different audiences	40	✓	✓
Total	100		

This subject adopts the method of 100% continuous assessment. Students' writing skills are evaluated through assessment tasks related to the learning outcome areas. Students are assessed on the accuracy and the appropriacy of the language used in fulfilling the assessment tasks, as well as the selection and organisation of ideas.

Students will be assessed on technical texts targeted at different intended readers, including h experts and non-experts in science and technology. This facilitates assessment of students' ability to select content and use language and style appropriate to the purposes and intended readers.

A process writing approach will be used to raise students' awareness of the importance of drafting and editing in the writing process, and to assess their ability to edit texts based on feedback on the first version.

Student Study Effort Expected

Class contact:	
• Seminars	26 h
Other student study effort:	
• Classwork-related, assessment-related, and self-access work	58 h
Total student study effort	84 h

Reading List and References

Required reading

Course materials prepared by the English Language Centre

Recommended readings

Behrens, L. and Rosen, L.J., "A Sequence for Academic Writing", 4th Edition, New York: Longman, 2010.

Graff, G., Birkenstein, C and Durst, R., "They Say/I Say: The Moves That Matter in Academic Writing", New York: W.W. Norton, 2008.

Ingre, D., "Technical Writing: Essentials for the Successful Professional", Mason, OH: Thomson, 2003.

	Johnson, S. & Scott, J., "Study and Communication Skills for the Biosciences", Oxford: Oxford University Press, 2009. Mulvaney, M.K. and Jolliffe, D.A., "Academic Writing: Genres, Samples, and Resources", New York: Pearson Longman, 2005. Pickett, N.A., Laster, A.A. and Staples, K.E., "Technical English: Writing, Reading, and Speaking", 8th Edition, New York, NY: Longman, 2001. VanAlstyne, J.S. and Tritt, M.D. "Professional and Technical Writing Strategies: Communicating in Technology and Science", Upper Saddle River, NJ: Prentice Hall, 2002.

Appendix II Grades and Codes for Subject Assessment

Grades/codes to denote overall subject assessments (and subject components*, if deemed appropriate)

Subject grades	Interpretation
A+	Exceptionally Outstanding
A	Outstanding
B+	Very Good
B	Good
C+	Wholly Satisfactory
C	Satisfactory
D+	Barely Satisfactory
D	Barely Adequate
F	Inadequate

Codes	***Interpretation***	Remarks
I #	Assessment to be completed	An incomplete grade must be converted to a regular grade normally in the following academic year at the latest.
N	Assessment is not required	—
P	Pass an ungraded subject	This code applies to an ungraded subject, such as industrial training.
U	Fail an ungraded subject	This code applies to an ungraded subject, such as industrial training.
M	Pass with Merit	This code applies to all General Education subjects for intake cohorts before 2010/11. The adoption or otherwise of this code to other subjects adopting a "Pass/Fail" grading system would be subject to the decision of individual Departments. The grade "Pass with Merit" can be awarded when the student's work exceeds the subject learning outcomes in the majority of regards.
L	Subject to be continued in the following semester	This code applies to subjects like "Project" which may consist of more than 1 part (denoted by the same subject code) and for which continuous assessment is deemed appropriate.
S	Absent from assessment	—
W	Withdrawn from subject	Dropping of subjects after the add/drop period is normally not allowed. Requests for withdrawal from subjects after the add/drop period and prior to examination will only be considered under exceptional circumstances. This code is given when a student has obtained exceptional approval from Department to withdraw from a subject after the "add/drop" period and prior to examination; otherwise, a failure grade (grade F) should be awarded.
Z	Exempted	—
T	Transfer of credit	—

* Entry of grades/codes for subject components is optional.

\# For cases where students fail marginally in one of the components within a subject, the BoE can defer making a final decision until the students concerned have completed the necessary remedial work to the satisfaction of the subject examiner(s). The students can be assigned an ' I ' code in this circumstance.

Note: Subjects with the assigned codes I, N, P, U, M, L, W, Z and T (if the subject is without grade transferred) will be omitted in the calculation of the GPA. A subject assigned code S will be taken as zero in the calculation.

Appendix III Codes for Final Assessment

Final assessment code	***Interpretation***
A	First Class Honours
B	Second Class (Division 1) Honours
C	Second Class (Division 2) Honours
D	Third Class Honours
K	Pass without Honours
E	Required to be deregistered from the programme because of failure to meet requirements.
J	University award not applicable, e.g. exchange-in students.
N	Suspension of study due to disciplinary action.
T	Eligible to progress
U	Expulsion due to disciplinary action.
W	Required to be deregistered from the programme because of withdrawal/absence.
X	Pending fulfilment of requirements for award.

Appendix IV Different types of GPA, and their calculation methods

Different types of GPA, and their calculation methods

Types of GPA	Purpose	Rules for GPA calculation
GPA	Determine Progression/ Graduation	(1) All academic subjects taken by the student throughout his study, both inside and outside the programme curriculum, are included in the GPA calculation. (2) For training subjects, including WIE and Clinical/Field subjects, departments can decide whether to include them in the GPA calculation. (3) For retake subjects, only the last attempt will be taken in the GPA calculation. (4) Level weighting, if any, will be ignored.
Semester GPA	Determine Progression	Similar to the rules for GPA as described above, except that only subjects taken in that Semester, including retaken subjects, will be included in the calculation.
Weighted GPA	To give an interim indication on the likely Award GPA	(1) Similar to the rules for GPA, except that only subjects inside the programme curriculum concerned will be included in the calculation. Subjects outside the programme curriculum will be excluded. (2) Departments can decide whether the training subjects are to be counted towards the Weighted GPA. (3) For retake subjects, only the last attempt will be taken in the Weighted GPA calculation. (4) A weighting of 2 for Level 1 and 2 subjects, and a weighting of 3 for Level 3 and 4 subjects, will be included in the calculation to determine the Honours classifications. (5) The weighted GPA will be the same as the Award GPA unless a student has taken more subjects than required.

Types of GPA	**Purpose**	**Rules for GPA calculation**
Major/Minor GPA	For reference and determination of award classification	*Major/Minor GPA* (1) Only subjects inside the curriculum of the Major/Minor Programmes will be taken in the Major/ Minor GPA calculation. (2) Departments can decide whether the training subjects, are to be counted towards the Major/Minor GPA. (3) For retake subjects, only the last attempt will be taken in the Major/Minor GPA calculation. (4) Up to 6 credits from the Major/GUR [including Language Communication Requirements (LCR) subjects at proficiency level] can be counted towards the chosen Minor. (Ref. Section 34.3) *Major GPA* Level weighting will be included in the calculation of Major GPA. *Minor GPA* Level weighting will <u>not</u> be included in the calculation of Minor GPA.
Award GPA	For determination of award classification	If the student has not taken more subjects than required, the Award GPA will be as follows: (1) For single Major: Award GPA = Weighted GPA (2) For Major/Minor programmes: Award GPA = Major GPA