Faculty of Computing
Sabaragamuwa University of Sri Lanka

STUDENT HANDBOOK

2023 – 2024

Faculty of Computing

Student Handbook

2023/2024

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Sabaragamuwa University of Sri Lanka
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Contents

SABARAGAMUWA UNIVERSITY OF SRI LANKA

Background

The Sabaragamuwa University of Sri Lanka (SUSL) was established under the Universities Act Number 16 of 1978 on 7th November 1995 and ceremonially inaugurated on 2nd February 1996. At present, the university has nine faculties, namely, Agricultural Sciences, Applied Sciences, Geomatics, Graduate Studies, Management Studies, Medicine, Social Sciences and Languages, Technology, and the recently established Faculty of Computing. The Faculty of Graduate Studies offers postgraduate degree Programmes of SUSL while all other faculties offer undergraduate degree Programmes. Except the Faculty of Medicine, which is established in Kuruwita, all the other faculties are established at Belihuloya in Rathnapura district of the Sabaragamuwa Province.

SUSL has ten academic centres/units namely, Center for Computer Studies (CCS), Staff Development Center (SDC), Career Guidance Unit (CGU), Center for Indigenous Knowledge and Community Studies (CIKCS), Centre for Research and Knowledge Dissemination (CRKD), Center for Open and Distance Learning (CODL), Center for Gender Equity and Equality (CGEE), Center for Quality Assurance (CQA), University Business Linkage Cell (UBLC) and Department of Physical Education.

Brief History

The SUSL originated as an Affiliated University College linked to the University of Sri Jayewardenepura, named the Sabaragamuwa Affiliated University College (SAUC), back in 1991 and was located in Belihuloya. On the recommendations presented by a committee appointed by the Ministry of Education and Higher Education in 1995, headed by the Deputy Minister of Higher Education, to explore the prospects of restructuring the affiliated university colleges, the government upgraded the SAUC to a national university, now known as the SUSL. The formation of the SUSL was declared through the Gazette Notification No. 896/2 of 7th November 1995 under section 21 of the Universities Act No. 16 of 1978. In the meantime, the two Affiliated University Colleges at Rahangala and Buttala which had been linked to the University of Sri Jayewardenepura and the University of Peradeniya respectively and then were integrated to form the Uva Campus of the SUSL, became the Faculties of Agricultural Sciences and Applied Sciences of the SUSL and were subsequently relocated in Belihuloya itself. Over the years, SUSL has demonstrated steadfast commitment to growth and development through the

establishment of faculties of Geomatics (2004), Graduate Studies (2016), Technology (2018), Medicine (2018), and Computing (2023).

Vision and Mission of the University

The vision of the Sabaragamuwa University of Sri Lanka is to be an internationally acclaimed centre of excellence in higher learning to produce dynamic human capital in creating value for society.

The mission of the Sabaragamuwa University of Sri Lanka is to create a conducive environment for producing competent graduates with social values by ascertaining and disseminating knowledge, developing skills, promoting innovation, enhancing university-industry collaboration and social responsibility.

University Logo

The University logo comprises a traditional oil lamp, rays of light, books, the Samanala (peak wilderness) mountain, gems, and sheaves of paddy, symbolizing the region and the people that it serves and the ideas for which they stand. The traditional oil lamp and the rays of light denote the imparting of knowledge and enlightenment; books represent education; the Samanala Mountain and gem stand for the Sabaragamuwa Province and Rathnapura District respectively, and the sheaves of paddy symbols show prosperity.

University Flag

University flag comprises two colours: maroon and gold, and the logo is in the centre of the flag. The maroon colour in the flag indicates maturity and the gold colour indicates knowledge.

Faculties and Degree Programmes

The Sabaragamuwa University of Sri Lanka offers the following degree Programmes through its nine faculties.

The Faculty of Agricultural Sciences (FAGS) offers B.Sc. Hons. Degree Programmes in Agricultural Sciences and Food Business Management through its three departments: the Department of Livestock Production, the Department of Export Agriculture, and the Department of Agribusiness Management.

The Faculty of Applied Sciences (FAPS) offers B.Sc. Hons. degree Programmes in Food Science and Technology, Environmental Sciences and Natural Resource Management, Chemical Technology, Computer Science and Technology, Applied Physics, Sport Sciences and Management, Physical Education through its four departments: The Department of Food Science and Technology, The Department of Natural Resources, The Department of Physical Sciences and Technology, and The Department of Sport Sciences and Physical Education.

The Faculty of Computing (FOC) offers B.Sc. Hons. degree Programmes in Computing & Information Systems, Software Engineering and Data Science through its three departments: Department of Computing and Information Systems, Department of Software Engineering, and Department of Data Science.

The Faculty of Geomatics (FOG) offers a B.Sc. Hons. Degree Programme in Surveying Sciences, through its two departments: the Department of Surveying and Geodesy and the Department of Cartography, Photogrammetry, Remote Sensing and Geographic Information Systems (GIS).

The Faculty of Management Studies (FMS) offers B.Sc. Hons. Degree Programmes in Business, Financial, Marketing, Tourism and Eco-Business Management through its four departments: the Department of Business Management, the Department of Accountancy and Finance, the Department of Marketing Management, and the Department of Tourism Management.

The Faculty of Social Sciences and Languages (FSSL) offers B.A. degree Programmes in Social Sciences and Languages through its five departments: the Department of Social Sciences, the Department of Languages, the Department of Economics and Statistics, the Department of English Language Teaching and the Department of Geography and Environmental Management.

The Faculty of Technology (FOT) offers Bachelor of Bio Systems Technology Hons. Degree and Bachelor of Engineering Technology Hons. Degree through its two

departments: the department of Bio Systems Technology and the Department of Engineering Technology.

The Faculty of Medicine (FOM) Offers the Degree of Bachelor of Medicine and Bachelor of Surgery (MBBS). It consists of the Department of Anatomy, Department of Biochemistry, Department of Physiology, Department of Community Medicine, Department of Forensic Medicine and Toxicology, Department of Medicine, Department of Microbiology, Department of Obstetrics and Gynaecology, Department of Paediatrics, Department of Parasitology, Department of Pathology, Department of Pharmacology, Department of Primary Care and Family Medicine, Department of Psychiatry and Department of Surgery.

The Faculty of Graduate Studies (FGS) awards Research Higher Degrees (MPhil and PhD) and conducts MSc Degree Programmes in Ayurvedic Hospital Management, Surveying Sciences, Master of Information Technology, Master of Business Administration (Specialization: Finance, marketing and Tourism) and Master of Arts in English and Education. FGS also offers Postgraduate Diploma Programmes in Business Administration, English and Education.

Officers and Administrative Staff of the University

Chancellor

Most Venerable Prof. Kamburugamuwe Vajira Thero

Officers

Vice Chancellor	Prof. M. Sunil Shantha
Dean/ Faculty of Graduate Studies	Prof. H.S.R. Rosairo
Dean/ Faculty of Agricultural Sciences	Prof. M.L.M.C. Dissanayake
Dean/ Faculty of Applied Sciences	Prof. R.M.K.T. Rathnayake
Dean/ Faculty of Computing	Prof. S. Vasanthanpriyan
Dean/ Faculty of Geomatics	Dr. H. Divithure
Dean/ Faculty of Management Studies	Prof. Athula C. Gnanapala
Dean/ Faculty of Medicine	Prof. M.N. Wickramaratne
Dean/ Faculty of Social Sciences & Languages	Dr. K.R.W.K.H. Abeywickrama
Dean/ Faculty of Technology	Prof. K.R. Koswattage
Registrar	Mr. Saman Uyangoda
Librarian	Mrs. T.N. Neighsoorei
Bursar	Mrs. Shirani De Silva

Administrative Staff

Deputy Registrar (Academic Establishments)	Mr. Kamal Gunawardana
Deputy Registrar (General Administrations)	Mr. Mohamed Rizan
Senior Asst. Registrar (Examinations)	Ms. V.B. De Labrooy
Senior Asst. Registrar (Capital Works and Planning)	Mrs. R.T.S. Ranasinghe
Senior Asst. Registrar (Student Affairs)	Mr. R. Senthuraan
Senior Asst. Registrar (CODL)	Mr. G.A.D.M. Thennakoon
Senior Asst. Bursar (Salaries)	Mr. R.M.N.K. Rathnayake
Asst. Registrar (Non-Academic Establishments)	Ms. G.W.N.R. Wijerathne
Asst. Registrar (Faculty of Agricultural Sciences)	Mr. G.A.D.M. Thennakoon

Asst. Registrar (Faculty of Applied Sciences) (Actg)	Mrs. P.A.P. Gunasekara
Asst. Registrar (Faculty of Geomatics)	Mrs. K.M. Poornima
Asst. Registrar (Faculty of Management Studies)	Mrs. P.A.P. Gunasekara
Asst. Registrar (Faculty of Social Sciences and Languages)	Ms. Y.S. Chandrasekara
Asst. Registrar (Faculty of Technology)	Mrs. N. Akalya
Asst. Registrar (Faculty of Medicine)	Ms. Archchana Y
Asst. Registrar (Post Graduate Studies)	Ms. Y.S. Chandrasekara
Asst. Registrar (Faculty of Computing) (Actg)	Mrs. K.M. Poornima
Asst. Bursar (Faculty of Graduate Studies)	Ms. G.K.M. De Silva
Asst. Registrar (Library Services)	Mrs. H.P.K.N.D. Siriweera
Asst. Registrar (Legal & Documentation)	Mrs. P.B.N. Fernando
Senior Asst. Bursar (Supplies)	Mr. W.A.M.P. Senadheera
Asst. Bursar (Payments)	Ms. G.K.N. Udeshi
Asst. Bursar (Accounts)	Ms. N.W.M.I. Chamarie
Asst. Bursar (Revenue)	Ms. G.K.M. De Silva
Asst. Bursar (CODL)	Mrs. N.W.N.P. Wijendra
Asst. Internal Auditor	Ms. G.G.N.N. Senevirathna
Curator	Mr. R.D. Rajapaksha
Works Engineer (Civil)	Mr. W.M.L. Manoj K. Wijesundara

FACULTY OF COMPUTING

Information at a Glance

Postal Address:	Faculty of Computing, Sabaragamuwa University of Sri Lanka, P.O. Box 02, Belihuloya, 70140, Sri Lanka
Telephone:	+94 (0)45 2 121 873
Website:	http://www.sab.ac.lk/computing
Email:	info@foc.sab.ac.lk
Province:	Sabaragamuwa
District:	Ratnapura
Police Division:	Balangoda
Divisional Secretariat:	Imbulpe
Grama Niladari Division:	Muttettuwegama
Distance to main towns:	19 km to Balangoda 65.5 km to Ratnapura 40 km to Bandarawela 66 km to Badulla
Nearest Hospital:	Divisional Hospital, Pambahinna
Nearest Police Station:	Samanalawewa Police Station
Nearest Post Office:	Sabaragamuwa University Sub Post Office
Nearest Railway Station:	Haputhale
Elevation:	606 m above MSL
Avg Annual temperature:	25 ^{0}C
Annual Rainfall:	1500 mm
Nearby Attractions:	Samanala wewa (9 Km) Pahanthuda Falls (5.5 Km) Surathali Falls (8.5 Km) Bambarakanda Falls (17 Km) Duvili Falls (45 Km)

History of the Faculty of Computing

The decade of skills development (2020 - 2030) has been designated with the goal of creating a digitally inclusive Sri Lanka and one that produces global technocrats with future-ready skills. In the meantime, the mandate for establishing the Faculty of Computing at SUSL was identified in the University Action Plan - 2021 "Way forward to a Smart University". This was further supported by the findings of the reports of national IT industry steering bodies including the "National IT - BPM Workforce Survey 2019", the findings of which called for a robust interaction between the education institutes and industry to produce a competent workforce.

In light of this, starting in July 2021, the academic staff of the Department of Computing and Information Systems at the Faculty of Applied Sciences, SUSL, initiated to prepare the proposal for the Establishment of FOC. Accordingly, a comprehensive need analysis survey was carried out employing different stakeholder groups including university academics, researchers, industry representatives, alumni, representatives of government agencies, and IT industry governing bodies. The findings of the survey revealed a widening demand-supply gap as the major threat moving forward. The proposal for the Establishment of FOC subsequently received the approval of the Faculty Board of the Faculty of Applied Sciences, the Senate, and the Council of the SUSL.

In November 2021, the proposal to the UGC Quality Assurance Council was submitted, which was approved by April 2022. The proposal was presented to the UGC and the UGC Commission approved the Establishment of the FOC on the 6th of October 2022. In 27.12.2022, under the Gazette Notification 2312/14, the FOC was established as the 9th Faculty of the SUSL with the three Departments: Department of Computing and Information Systems, Department of Data Science, and Department of Software Engineering.

Present Situation

At present, the FOC is empowered with a highly qualified and competent panel of academic staff including two professors in Computer Science, four senior lecturers, and ten lecturers. Meanwhile, eminent senior academics and industrialists are contributing as visiting professionals in conducting lectures and practical sessions in the respective disciplines.

The FOC is equipped with physical facilities including two well-established computer laboratories. Further, it maintains close collaborations with the industry

which has enabled to secure opportunities for the undergraduates for early industrial exposure and employment upon graduation.

Today, the FOC is successfully progressing introducing numerous initiatives for research and knowledge dissemination including the International Conference on Advanced Research in Computing (ICARC), the Computing Undergraduate Research Symposium (ComURS), the Sabaragamuwa University Journal of Computer Science (SUJCS) and the ComSpective the ICT Technical Magazine. The undergraduates are actively involved in numerous extra-curricular activities as the Society of Computer Sciences (SOCS), IEEE Student Branch of SUSL, WIE Affinity Group of IEEE Student Branch of SUSL and IEEE Computer Society Student chapter of SUSL - the newest addition.

Vision and Mission of the Faculty of Computing

Vision:

> "To become the centre of excellence in computing education in Sri Lanka and to lead the next generation of computer scientists in advancing research and education that impacts the global society."

Mission:

> "To produce computing graduates to design and develop quality software and engineering solutions, be able to work effectively within challenging environments and will be good professionals. Provide high-quality, broad-based education and experiential learning in computing; create knowledge through pioneering scholarship and impactful research; enrich our students' development and leadership skills; nurture the inherent innovation of our students."

Aims/Objectives of the Faculty of Computing

- To produce highly qualified and well-trained graduates specializing in various computing disciplines, who are capable of responding to current and emerging requirements of the Sri Lankan IT/BPM industry.
- To contribute in realizing the vision of Sri Lanka to become a knowledge hub by producing sufficient numbers of competent graduates, recognizing the responsibility as a Sri Lankan state university and thereby expanding the horizons of Sri Lankan IT-BPM industry to embark on advanced computing solutions for the global market.

- To produce graduates who are well equipped with the perfect blend of theoretical and practical knowledge, skills, and dispositions required in performing competently in the chosen career under the respective computing discipline.
- To produce graduates who reflect the special nature of the chosen computing discipline who are capable in building information processing into organisational procedures and systems; providing software solutions using appropriate software development practices while integrating the engineering rigor; and extracting knowledge from data utilizing the principles, processes, and techniques for understanding phenomena via the analysis of data.
- To produce graduates who contribute to the body of new knowledge in current as well as emerging disciplines of computing through engaging in cutting-edge research and knowledge dissemination.
- To establish and maintain relations with governmental, industrial, and academic institutions for the purpose of benchmarking, research and development, and technology-sharing.
- To contribute to the development of the region and the community at large through various initiatives in digital empowerment.
- To produce graduates who make tangible contributions in the chosen career who capture future trends and visions from industry, from research, and from across the entire spectrum of society.

Faculty Board

The Faculty Board is responsible for recommending and reporting to the Senate on matters relating to teaching, examinations, courses of study and research in departments of the FOC, for appointing committees (excluding members of FOC) to report on any special subjects, and for recommending suitable persons for appointment as examiners.

The Faculty Board of FOC shall consist of the following members:

- The Dean of that Faculty;
- All permanent Senior Professors, Professors, Associate Professors, Senior Lecturers and Lecturers of the Departments of Study comprising FOC;
- Two members elected by the Lecturer (Probationary) staff of FOC from among such Lecturers;
- Two members of the permanent staff attached to FOC and who are imparting instructions;
- Two students elected by the students of FOC from among their number; and

- Three persons not being members of the staff of the University elected by the Faculty Board from among persons of eminence in the areas of study relevant to the FOC.

Academic, Administrative and Academic Supportive Staff of the Faculty

Office of the Dean

Dean		
Prof. S. Vasanthapriyan B.Sc. (Special) (Hons)(UPDN) M.Sc. (TU/e-Netherlands) Ph.D. (China) Professor	0452121873 (O) 0717851500 (M)	dean@foc.sab.ac.lk priyan@foc.sab.ac.lk
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Department of Computing and Information Systems

Head of the Department		
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Department of Software Engineering

Head of the Department (Acting)		
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Department of Data Science

Head of the Department		
Dr. (Mrs.) U.A.P. Ishanka B.Sc. (Special) (Hons) (SUSL) M.Sc. (Japan) Ph.D. (Japan) Senior Lecturer (Grade I)	0452121867 (O) 0772352661 (M)	ds@foc.sab.ac.lk piumi@foc.sab.ac.lk
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Ms. U.P. Kudagamage B.Sc. (Hons) (SUSL) Lecturer (Prob.) (On study Leave)	0715790285 (M)	upeksha@foc.sab.ac.lk

Student Services and Amenities

SUSL provides a number of services and amenities for students to ensure a healthy, safe, and entertaining environment in pursuing their academic and personal development at the university.

Counselling Services

Professional counselling services are available under a confidential atmosphere, at students' request. To obtain this service, students have to contact their faculty advisors, deputy senior student counsellor, or senior student counsellor.
Please visit:
https://www.sab.ac.lk/computing/student-life/mentoring

Further the psychological counselling unit (Sith Arana) provides counselling to students on the various problems encountered during their studies. Services are offered by academic staff members trained in professional counselling. Students can contact the counsellors for an appointment.
Please visit: https://www.sab.ac.lk/fssl/sith-arana-visit-us

Career Guidance Services

The University Career Guidance Unit (CGU) unit offers services in the area of developing undergraduates' career prospects.
Please visit: https://www.sab.ac.lk/cgu

Financial Assistance

Bursary and Mahapola Scholarship payments will be made through the bank. Exact date of payment is subject to change from month to month but will be notified in advance. For further information on Bursary and Mahapola payment related issues, students are advised to contact the Senior Assistant Registrar (Student Affairs).

Medical Facilities

All students can obtain basic medical care at the University Medical Centre, which is open from 8.00 a.m. to 4.00 p.m. on weekdays. In addition, the Pambahinna Divisional hospital is located close to the university.

Banking Facilities

Students can open accounts with the Bank of Ceylon's branch near the main entrance of the University and the People's Bank branch at Pambahinna junction. They

provide nearly all of the services of a regular bank branch office. Two ATM machines are located near the main entrance to the University.

Library Facilities

The main library of the university is rich with a huge collection of printed materials, which includes textbooks, journals, magazines, final year project reports, bulletins and a reference collection. In addition, it includes gazette and daily newspapers in Sinhala, Tamil and English. Moreover, the main library provides an online catalogue enabling students online searching and reservations. The library handles all the transactions through the library-automated system. For open hours and more details please visit: https://www.sab.ac.lk/lib/.

Laboratory Facilities

There are two computer centres in the faculty, having a sufficient number of state-of-the-art computers and utilities. The required application packages are available. Software facilities are available for various types of computer applications. The Local Area Network provides e-mail and Internet facilities through a leased line and Wi-Fi.

Sports Facilities

The sports facilities include a playground, 25 metre swimming pool, two tennis courts, badminton, squash, volleyball, basketball, and netball courts, weightlifting and exercise equipment. Please contact the Physical Education Department for details (Tel: 045-2280036).

Accommodation Facilities

Accommodation with basic facilities are provided for students in the first, third, and fourth academic years considering the distance to their permanent residential address. In the second academic year (Semester III and IV), students are required to arrange their own accommodation, as the university does not provide hostel facilities.

Canteen

The University student canteen offers breakfast, lunch and dinner as well as tea, soft drinks and various snacks throughout the day. Hours of operation are from 7.00 a.m. to 9.30 p.m. It may be necessary to order main meals in advance. Two hostel canteens are available for hostellers. A traditional food court ('Hela Bojun Hala') is also located in the university premises providing traditional food items at affordable rates.

Welfare Shop

You can purchase groceries, stationery, toiletries, soft drinks and snacks at the Welfare Shop. Opening Hours are: weekdays from 7.00 a.m. to 8.00 p.m. and Sundays from 2.00 p.m. to 8.00 p.m.

Regular Mail

Incoming mail is sorted at the Main Office and then kept in student mailboxes near the department offices. To ensure that your letters reach you quickly, please request the sender to use the following address including the postal code:

Your name
Relevant Department or Faculty
Sabaragamuwa University of Sri Lanka
P.O. Box 02
Belihuloya 70140
Sri Lanka

Regular postal services are available at the Sabaragamuwa University Sub-Post Office. Note that to receive a money order at this post office; the sender must indicate the "Sabaragamuwa University Post Office" as the paying office. The post office is located just outside the main gate.

Telephone Calls

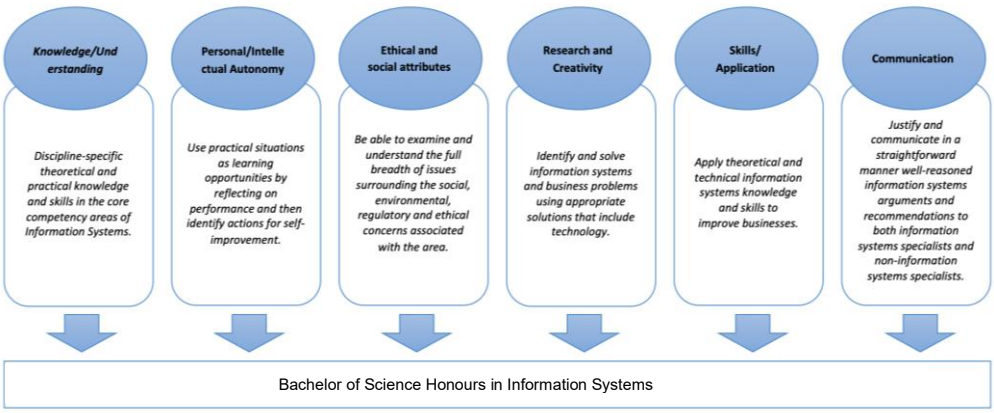
You can make outgoing telephone calls from the Telephone Operator's Room, located opposite the Main office. Messages from incoming calls (Tel: 045-2280014) will be forwarded to you as soon as possible. To help speed up the process, the caller should leave the recipient's name and specify which degree programme he or she is following.

DEPARTMENT OF COMPUTING & INFORMATION SYSTEMS

Degree Programme

Bachelor of Science Honours in Information Systems
[BScHons (Inf Sys)]

Anticipated Graduate Profile



Guidelines for course codes and credits

- Each course code consists of four digits together with the prefix (alphabet letters)
- Prefix alphabet letters (IS) denote the abbreviation to the name of degree Programme
- The first digit of each course code is the corresponding semester of study (1-8).
- Second digit represents the revision of the subject and it will increment if the subject is revised.
- Third and fourth digits represent the subject code.

Example: The course code of IS1101 denotes the following;

Abbreviated name of degree Programme	Semester	Revision Number	Subject Code
BScHons (Inf Sys)	1	1	01

Note: There are no spaces or special characters in the course code.

Summary of the Courses

Table 1: Courses offered in the Semester I			
Course Code	Course Title	No of Credits	Compulsory or Elective
IS1101	Fundamentals of Information Systems	2	Compulsory
IS1102	Structured Programming Techniques	2	Compulsory
IS1103	Structured Programming Practicum	1	Compulsory
IS1104	Theories of Information Systems	2	Compulsory
IS1105	Computer System Organization	2	Compulsory
IS1106	Foundations of Web Technologies	2	Compulsory
IS1107	Personal Productivity with Information Technology	1	Compulsory
IS1108	Fundamentals of Mathematics	2	Compulsory
IS1109	Statistics & Probability Theory	2	Compulsory
IS1110	Communication Skills I	2	Compulsory (Non-GPA)
IS1111	Academic Integrity	1	Compulsory (Non-GPA)
IS-EGP-1101	General English I	2	Compulsory (Non-GPA)
	Total	21	

Table 2: Courses offered in the Semester II			
Course Code	Course Title	No of Credits	Compulsory or Elective
IS2101	Object Oriented Programming	2	Compulsory
IS2102	Object Oriented Programming Practicum	1	Compulsory
IS2103	Emerging IS Technologies	1	Compulsory
IS2104	Database Systems	2	Compulsory
IS2105	Database Management Systems Practicum	1	Compulsory
IS2106	System Analysis & Design	1	Compulsory
IS2107	Social & Professional Issues	1	Compulsory
IS2108	Human Computer Interaction	2	Compulsory
IS2109	Information Assurance & Security	2	Compulsory
IS2110	Software Project Initiation & Planning	1	Compulsory
IS2111	Advanced Mathematics	2	Compulsory
IS2112	Communication Skills II	2	Compulsory (Non-GPA)
IS-EGP-1201	General English II	2	Compulsory (Non-GPA)
	Total	20	

Table 3: Courses offered in the Semester III			
Course Code	Course Title	No of Credits	Compulsory or Elective
IS3101	Object Oriented Analysis & Design	2	Compulsory
IS3102	Data Structures & Algorithms	2	Compulsory
IS3103	IT Governance	2	Compulsory
IS3104	Software Engineering	2	Compulsory
IS3105	IS Risk Management	2	Compulsory
IS3106	IS Sustainability	1	Compulsory
IS3107	Management Information Systems	2	Compulsory
IS3108	E-Business	1	Compulsory
IS3109	Digital Innovation	2	Compulsory
IS-EAP-2101	Academic English I	2	Compulsory (Non-GPA)
	Total	18	

Table 4: Courses offered in the Semester IV			
Course Code	Course Title	No of Credits	Compulsory or Elective
IS4101	IT Auditing	2	Compulsory
IS4102	Web Application Development	2	Compulsory
IS4103	Operating Systems	2	Compulsory
IS4104	System Administration and Maintenance	2	Compulsory
IS4105	IT Procurement Management	1	Compulsory
IS4106	Software Architecture	2	Compulsory
IS4107	Professionalism & Ethics in Computing	1	Compulsory
IS4108	IS Strategies	1	Compulsory
IS4109	Agile Software Development	2	Compulsory
IS4110	Capstone Project	2	Compulsory
IS-EAP-2201	Academic English II	2	Compulsory (Non-GPA)
	Total	19	

Table 5: Courses offered in the Semester V			
Course Code	Course Title	No of Credits	Compulsory or Elective
IS5101	Entrepreneurship & Innovation	1	Compulsory
IS5102	Enterprise Architecture	1	Compulsory
IS5103	High Performance Computing	2	Compulsory
IS5104	Software Process Management	1	Compulsory
IS5105	Business Process Management	2	Compulsory
IS5106	UI/UX Practicum	1	Compulsory

IS5107	Project Management Practicum	1	Compulsory
IS5108	Business Intelligence	2	Compulsory
IS5109	IS Project for Community	1	Compulsory
IS-EBP-3101	Business English	2	Compulsory (Non-GPA)
Students should select courses covering 06 Credits from the following elective courses			
IS5110	Advanced Database Systems	2	Elective
IS5111	Data Communication & Networks	2	Elective
IS5112	Design Patterns & Anti-patterns	2	Elective
IS5113	Software Quality Assurance	2	Elective
IS5114	Data Mining & Analytics	2	Elective
	Total (Compulsory + Electives)	20	

Table 6: Courses offered in the Semester VI			
Course Code	Course Title	No of Credits	Compulsory or Elective
IS6101	Industrial Training	6	Compulsory
	Total	6	

Table 7: Courses offered in the Semester VII			
Course Code	Course Title	No of Credits	Compulsory or Elective
IS7101	Research Methodologies	2	Compulsory
IS7102	IT Law	1	Compulsory
IS7103	Business Process Simulation	2	Compulsory
IS7104	Enterprise Modelling Ontologies	2	Compulsory
IS7105	Organizational Behavior & Management	1	Compulsory
IS7106	Cloud Computing	2	Compulsory
Students should select courses covering 04 Credits from the following elective courses			
IS7107	Mobile Application Development	1	Elective
IS7108	Web Service Technologies	2	Elective
IS7109	Geographical Information Systems	2	Elective
IS7110	Statistical Distribution & Inferences	1	Elective
IS7111	Advanced Programming Practicum	1	Elective
IS7112	Machine Learning	2	Elective
	Total (Compulsory + Electives)	14	

Table 8: Courses offered in the Semester VIII			
Course Code	Course Title	No of Credits	Compulsory or Elective
IS8101	Research Project in IS	8	Compulsory
IS8102	Business/IT Alignment	2	Compulsory
IS8103	Human Resource Management	2	Compulsory
IS8104	Scientific Communication	1	Compulsory
IS8105	IS Economics	2	Compulsory

IS8106	Computer System Security	2	Compulsory
Students should select courses covering 04 Credits from the following elective courses			
IS8107	Supply Chain Management	2	Elective
IS8108	Advanced Computer Networks	2	Elective
IS8109	Process Mining	2	Elective
IS8110	Digital Business Model	1	Elective
IS8111	Game Development	2	Elective
	Total (Compulsory + Electives)	21	

Summary of Credits Required

	Semester I	Semester II	Semester III	Semester IV	Semester V	Semester VI	Semester VII	Semester VIII
Credited and Compulsory courses	16	16	16	17	12	06	10	17
Credited and Elective courses	-	-	-	-	06	-	04	04
Credited, Compulsory and Non-GPA Courses	05	04	02	02	02	-	-	-
Total credits	41		37		26		35	
Total credits for the degree programme	139							

Detailed Syllabus

N.B.

TH - Theory
PRS - Practical
IFV - Industrial Field Visit
WS - Workshop
THS - Thesis
PR - Project Report

Semester I				
IS1101	Fundamentals of Information Systems	TH	-	-
Information concepts: Data, information, knowledge, and wisdom; cost/value and quality of information; system concepts; system performance and standards; system components and relationships; organizations and information systems; systems development; competitive advantage of information systems; global challenges in information systems; and IS career paths.				

IS1102	Structured Programming Techniques	TH	-	-
Introduction to Programming: Introduction to compilers & interpreters, Data types, Variables, Expressions & Assignment Statements, Console Input/Output, Libraries & Namespaces. Flow Control: Branching Mechanisms, Loops. Function Basics: Predefined Functions, User-Defined Functions, Scope Rules. Parameters: Parameters, Default Arguments. Arrays: Introduction to Arrays, Array manipulation, Multidimensional Arrays. Pointers: Introduction to pointers, Pointer arithmetic. Recursion: Recursive functions. Exception Handling: Testing & Debugging. File Reading & Writing.				

IS1103	Structured Programming Practicum	-	PRS	-
Identify & describe uses of Data types, Variables, Expressions & Assignment Statements, Console Input/ Output and Libraries. Modify & expand short programmes that use standard conditional & iterative control structures. Write programmes using functions, parameter passing, choose appropriate conditional & iteration constructs for a given programming task. Write programmes using arrays, standard conditional & iterative structures & pointers. Demonstrate the concept of recursion by examples, identify the base case & the general case of a recursively-defined problem. Demonstrate file handling & exception handling.				

IS1104	Theories of Information Systems	TH	-	-
Set of theories centered around the IS lifecycle, including: DeLone and McLean's Success Model, Technology Acceptance Model, Unified Theory of Acceptance and Use of Technology, User Resistance Theories, Task-Technology Fit Theory, Process Virtualization Theory, Theory of Deferred Action. Strategic and economic theories, including: Resource-Based View, Theory of Slack Resources, Portfolio Theory, Theory of the Lemon Markets, Technology – Organization – Environment				

Framework, Contingency Theory, Porter's Competitive Forces Model, Business Value of IT, Diffusion of Innovations, Punctuated Equilibrium Theory, Discrepancy Theory Models, Institutional Theory, A Multi-level Social Network Perspective, Expectation Confirmation Theory, Stakeholder Theory. Socio-psychological theories including: Personal Construct Theory, Psychological Ownership and the Individual Appropriation of Technology, Transactive Memory, Language-Action Approach, Organizational Information Processing Theory, Organizational Learning, Absorptive Capacity, and the Power of Knowledge, Actor-Network Theory, Structuration Theory, Social Shaping of Technology Theory, An IT-Innovation Framework, Yield Shift Theory of Satisfaction, Theory of Planned Behavior, An Interpretation of Key IS Theoretical Frameworks using Social Cognitive Theory. Methodological theories including: Critical Realism, Grounded Theory and Information Systems: Are We Missing the Point?, Developing Theories in Information Systems Research – The Grounded Theory Method Applied, Narrative Inquiry, Work System Method.

IS1105	Computer System Organization	TH	PRS	-

Basic Concept and Computer evolution: Organization and Architecture, the evolution of the Intel x86 Architecture, Embedded Systems, ARM architecture. Computer Performance Issues: Multicore, MIC and GPGPUs, Basic Measures of Computer Performance, benchmark and SPEC. Computer Function and interconnection: Computer Bus Interconnection, Point to Point Interconnection. Computer Memory System: Cache Memory Principles, Semiconductor main memory, External memory. Input/output: External Devices, I/O Modules, Interrupt Driven I/O, Programmed I/O, I/O channels and processors, External Interconnection Standards. Arithmetic and Logic: number system, Integer Representation, Floating Point representation, Digital logic, Combinational Circuits, Sequential Circuits, Programmable Logic Devices. The central Processing Unit: Machine Instruction Characteristics, Addressing Modes, Assembly language, Processor, Instruction Level Parallelism and superscalar Processor. Parallel Organization: Parallel processing, Multicore computers, General purpose Graphic processing Unit. Practical: Using a graphical simulation tool for designing and simulating logic circuits; digital logic design; implementation and simplification of Boolean functions; combinational logic modules—adders and subtractors; sequential logic, flip-flops, FSM analysis and design; and an introduction to assembly language programming.

IS1106	Foundations of Web Technologies	TH	PRS	-

Internet fundamentals. HTML. Cascading Style Sheets (CSS). Client-side Scripting: JavaScript, Typescript and pug, AJAX. Introduction to UI Frameworks with responsive front-end design. Introduction to Browser based developer tools. Hands on experience in web tools.

IS1107	Personal Productivity with Information Technology	TH	-	-

Knowledge work productivity concepts. Advanced functions and features of productivity tools to support personal and group productivity: DAX, Power BI

(Pivot, Charts, Tables), What-if analysis. Professional document design (latex implementation). Conduct effective communication using digital tools (Emails, shared documents). Effective presentation design (Example: formatting tool like Latex, Power point). Presenting scientific materials to lay audience. Ethics and plagiarism.

IS1108	Fundamentals of Mathematics	TH	-	-

Linear Algebra. Matrices, Vector spaces & subspaces. Linearly independent & dependent vectors, Dimension rank & the basis of vector spaces. Linear transformations, Systems of linear equations, Determinants. Diagonalization of matrices, Functions & relations. Sets, cardinality Cartesian product. Ordered pairs, Bijective mappings, Equivalence relations. Logic Propositions, Truth tables, Symbolic statements, Disjunctive & conjunctive normal forms. Karnaugh maps

IS1109	Statistics & Probability Theory	TH	-	-

Probability: Venn diagrams. Tree diagrams & Cartesian diagrams. Conditional Probability - The occurrence of an event given that another event has already occurred. Bayes' theorem & applications - An extension of conditional probabilities. Statistics: Population & Sample - Population: all the objects that a person is interested in. Sample: a subset of the population which is used to make inferences about the population. Types of random variables - Discrete & continuous random variables. Data Collecting - Experimental studies & observational studies. Data Summarizing Techniques - Descriptive statistics: mean, median, mode, inter quartile range, standard deviation etc. Data Visualizing Techniques - Techniques to visualize continuous & discrete variables. Measure of Central tendency - Mean, median, mode, Measure of Dispersion - Standard deviation, variance & inter quartile range. Mean & Variance of Random Variables - Relationship between the mean & the variance of random variables

IS1110	Communication Skills I	TH	-	-

Introduction to Communication: Purpose of Communication, Process of Communication, Importance of Communication in Business, Differences between Technical and General Communication, Barriers to Communication, Measures to Overcome the Barriers to Communication. Types of Communication: Verbal Communication-Importance of verbal communication- Advantages of verbal communication- Advantages of written communication, Significance of Non-verbal Communication. Listening Skills: Listening Process, Classification of Listening, Purpose of Listening, Common Barriers to the Listening Process, Measures to Improve Listening, Listening as an Important Skill in Work Place. Language for Communication: Language and Communication, General Principles of Writing, Improving Writing Skills, Essentials of good style, Expressions and words to be avoided, Grammar and Usage. Communication in Organizations: Internal Communication, Stake Holders in Internal Communication, Channels of Internal Communication, External Communication, Stake Holders in External Communication, Channels of External Communication. Communication Network: Scope and Types of Communication Network, Formal and Informal

Communication Network, Upward Communication, Downward Communication, Horizontal Communication, Diagonal Communication. Writing Business Letter: Importance of Business Letters, Difference between Personal and Business Letters, Structure and Format of Business Letters, Types of Business Letters.

IS1111	Academic Integrity	TH	-	-
Introduction to academic integrity, Academic integrity policies, Plagiarism, collusion and contract cheating, Putting academic integrity into practice, Research ethics, Citing and referencing, Reading and Note-making, Critical Thinking.				

IS-EGP-1101	General English I	TH	-	-
Refer English Curriculum (Page 88 & 89)				

Semester II				
IS2101	Object Oriented Programming	TH	-	-
Fundamentals of Object-Oriented Programming; Classes & Objects. Data Abstraction. Information Hiding & Encapsulation. Methods: Void methods, return methods, argument passing. Inheritance. Polymorphism: Method overloading and method overriding. Abstract Classes. Exception Handling. Files & Database connections.				

IS2102	Object Oriented Programming Practicum	-	PRS	-
Installation & configuring an IDE for OOP language: setting up path, environmental variable. Implement Class, Objects, Variables, Identifiers, Keywords, Data types, Arithmetic/logical Operators. Demonstrate Control statement (If-else, Switch), Loops (while, do-while, for). Implementation of Arrays. Implementation of Methods, Passing parameters, Arguments, Constructors. Implementation of OOP Concepts: Abstraction, Encapsulation, Inheritance (Specialization and Generalization) and Polymorphism. Applications of OOP concepts to solve real life problems.				

IS2103	Emerging IS Technologies	TH	-	WS
Emerging technologies: Contrasts between traditional & emerging technologies. Driving forces behind emerging technologies and technology life cycles. Adoption rates & assessment process. Disruptive technologies: Communication Communities, Collaboration, Hosted services (e.g., social networks, web culture, virtual workforce). Blockchain. DevOps. Cloud edge computing. Computer-Supported Cooperative Work and Tools. Tracking, Searching, Advertising & publishing on the web.				

IS2104	Database Systems	TH	-	-
Introduction to Databases: Definition of the database, database system, data models, database applications. Database system architecture, characteristics of database approaches. Database development process. Data models. Relational model. ER model. Schema Mapping. Designing: Logical design: Relational database model,				

Logical view of data, keys, integrity rules, Normalization. Relational algebra: Introduction, Selection & projection, set operations, renaming, Joins, Division, syntax, semantics, Operators, Grouping & ungrouping, relational, Triggers.

IS2105	Database Management Systems Practicum	-	PRS	-
Database Management tools: Installation and Setting up the environment. Create Databases & Tables, Modifying Databases & Tables. Inserting Table Data, Modifying Table Data. Querying Data. Functions (String Functions, Date & time functions, Numeric Functions, Aggregate Functions). Joining Tables (Querying Multiple Tables, Joining Tables with SELECT, Table Name Aliases, Inner Joins, and Outer Joins).				

IS2106	System Analysis & Design	TH	-	-
System Analysis Fundamentals: Fundamentals System Analysis and Design (SA&D) concepts, Roles of system analyst, System development life cycle, depicting system graphically, determining feasibility, activity planning and control. Evolution of software development models. Information requirements analysis. Process requirements analysis. The essentials of design. Deployment and maintenance				

IS2107	Social & Professional Issues	TH	-	-
History of computing, social context of computing. Methods & tools of analysis: consequence, duty and right based ethical theories. Professional & ethical responsibility. Risks & liability of computer-based systems. Intellectual property, privacy & civil liberties. Computer crime, customs & law. Economic issues in computing. Philosophical frameworks.				

IS2108	Human Computer Interaction	TH	-	-
HCI Principles. Usability principles. Building a simple GUI, Human abilities. Human-centered software development, cultural aspects, human-centered software evaluation. GUI design, GUI programming. HCI aspects of multimedia systems. HCI aspects of collaboration & communication. Validation of usability & user experience. Handling errors & help.				

IS2109	Information Assurance & Security	TH	-	-
Fundamental aspects of security: CIA, security mindset, design principles, system/security life cycle. Security Implementation Mechanisms (Guards, Gates, Cryptography, steganography). Information Assurance Analysis Models (Threats, Vulnerabilities, Attacks, Countermeasures). Disaster and Recovery. Security Mechanisms: Cryptography, Authentication, Redundancy, Intrusion Detection. Operational Issues: Trends, Auditing, Cost-Benefit analysis, Asset Management, Standards, Enforcements, Legal Issues. Policy: Creation & Maintenance of Policies, Prevention, Avoidance, Domain, Integration. Attacks: Social Engineering, Denial of Service, Protocol Attacks, Active & Passive Attacks, Buffer Overflow Attacks, Malware. Forensics: Legal Systems, Digital Forensics, Rules of Evidence, Search & Seizure, Digital Evidence, Media Analysis.				

IS2110	Software Project Initiation & Planning	TH	-	WS
Develop Project Charter (Inputs, Tools & Techniques, Outputs). Develop Project Management Plan (Inputs, Tools & Techniques, Outputs). Direct & Manage Project Work (Inputs, Tools & Techniques, Outputs). Manage Project Knowledge (Inputs, Tools & Techniques, Outputs). Monitor & Control Project Work (Inputs, Tools & Techniques, Outputs). Perform Integrated Change Control (Inputs, Tools & Techniques, Outputs), Close Project or Phase (Inputs, Tools & Techniques, Outputs).				

IS2111	Advanced Mathematics	TH	-	-
Functions & relations - relations: an association between two or more sets. Functions: a binary relation. Sequences - An enumerated collection of objects in which repetitions are allowed & order does matter. Series - The addition or multiplication of multiple quantities. Errors Numerical Solution of Nonlinear Equations. Interpolation Theory - The theory of estimating data points within a known data set. Numerical solution of systems of Linear Equation. Numerical Differentiation & integration. Numerical methods for differential equations. Graph theory.				

IS2112	Communication Skills II	TH	-	-
Writing Memos Circulars and Notices: What is a Memo?- Principles of précis writing- Approaches to memo writing- Characteristics of a memo- Guidelines for writing memos- Language and writing style of a memo- Format of a Memo, Circulars- Guidelines for writing a circular- Languages and writing style of a circular- Format of a circular, Notices- Purpose- Format- Important points to remember while writing a notice. Report Writing: Features of Writing a Good Report, Purpose of Report Writing, Difference between Business Report and Engineering Report-Characteristics of writing a good report-Importance of communication in report writing, Guidelines for Report Writing, Steps in Report Writing, Structure of Report, Types of Reports and Different Formats. Writing E-mail: Principles of E-mail, E-mail Etiquette, Overcoming Problems in E-mail Communication. Oral Communication Skills: Oral Business Presentation- Purpose –Audience-Locale, Steps in Making a Presentation- Research and planning-Structure and style-Preparation –Presentation, Delivering a Presentation. Meetings: Types of Meetings, Importance of Business Meetings, Different Types of Business Meetings, Conducting Meetings-Selecting Participants-Developing Agendas-Opening Meetings-Establishing ground rules for meetings-Time Management-Evaluations of meeting process-Evaluating the overall meeting-Closing meetings, Common Mistakes Made at Meetings. Reading Skills: Reading Skill, Purpose of Reading, Types of Reading, Techniques for Effective Reading. Employment Communication – Resume: Contents of Good Resume, Guidelines for Writing Resume, Different Types of Resumes, Reason for a Cover Letter to Apply for a Job-Format of Cover Letter, Different Types of Cover Letters. Employment Communication – Job Interview: Importance and Factors Involving Job Interview, Characteristics of Job Interview, Job Interview Process, Job Interview Techniques-Manners and etiquettes to be maintained during an interview, Sample Questions Commonly asked During Interview.				

IS-EGP-1201	General English II	TH	-	-
Refer English Curriculum (Page 88 & 89)				

Semester III				
IS3101	Object Oriented Analysis & Design	TH	PRS	-
Managing design complexity with OOAD. Evolution of the object-oriented paradigm. Classes & Objects: Associations, Aggregation, Inheritance; Polymorphism, Abstraction, Encapsulation. Unified process. Notation: Unified Modeling Language. Use Case Diagrams. Class Diagrams. Sequence Diagrams. Activity and component diagrams. Behavioral State Machine Diagrams. OOAD in Agile. Hands on experience using CASE tools.				

IS3102	Data Structures & Algorithms	TH	PRS	-
Primitive data types: arrays, structures, pointers, memory allocation, iteration & recursion. Singly & doubly linked lists. Stack and Queue. Trees, binary search trees & basic operations. Hash tables. Graphs & basic algorithms on graphs: depth first & breadth first search, Dijkstra's algorithm. Sorting algorithms: quick sort, bubble sort, selection sort, merge sort, tree sort. Complexity analysis of algorithms. Hands on experience on data structures & algorithms.				

IS3103	IT Governance	TH	-	-
Introduction to Governance: Corporate Governance, Enterprise Governance, Business Governance. IT Governance: Business IT Alignment, Necessity for IT Governance. Drivers for IT Governance: Information Economy & Intellectual Capital, Governance Convergence. Strategic & Operational Risk management in IT Governance: Compliance Risk, Information Risk. Strategic & Operational Risk management in IT Governance: Issues of Inadequate IT Governance. Achieving IT Governance: Objectives of IT Governance, Structural Issues in IT Governance, Maturity in IT Governance. IT Governance Frameworks: Constructing IT Governance Frameworks, Third Party governance frameworks, proprietary Governance Frameworks, Benefits of IT Governance Frameworks. Effective implementation of IT Governance. Future of IT Governance.				

IS3104	Software Engineering	TH	-	-
Software Engineering concepts. Introduction to Software engineering frameworks. Requirements & Specification. Software Design. Software implementation. Software Testing & Quality Assurance. COTS & Reuse. CASE Tools. Software metrics & Reliability Assessment. CMMI. Team Organization & people management. Software Estimation. Software Maintenance. Software evolution				

IS3105	IS Risk Management	TH	-	-
Background of Risk Management; Risk Management Processes: Risk Identification, developing a Risk Management Plan; Analyse & Prioritize Risks: Qualitative Risk				

Analysis, Quantitative Risk Analysis, Develop Risk Responses, Risk Monitoring & Control; Risk Assessment Frameworks (OCTAVE, FAIR, NIST SP800-30, and ISO 27005); Application of Risk Assessment Frameworks; Authentication & Authorization; Intrusion Detection.

IS3106	IS Sustainability	TH	-	-
Introduction to Sustainability. Adaptability of systems. Legal issues surround reusing data collected for another purpose. Processes to support ethical behavior to the society /to an individual/ in organizations. Activities to support ethical behavior in organizations/ for an individual/ to the society. Performance criteria to support ethical behavior by a person / in organizations/ to the society.				

IS3107	Management Information Systems	TH	-	-
Management within the organization: Management activities, Roles and Levels; Management Planning, Controlling and Strategic planning. Decision making and using MIS: Measurement of MIS performance and capabilities. MIS applications and relationships: Introduction to different types of Information Systems. Databases and data warehouses and their relevance to MIS; Networks, Internet and MIS. Development of MIS: Managing MIS Project, Techniques and methodologies for supporting MIS development. Customer Relationship Management (CRM) and Supply Chain Management (SCM). Financial Systems and E-Commerce, Business Process Redesigning using new trends in MIS (ERP, Mobile and Cloud enabled MIS etc.).				

IS3108	E-Business	TH	-	-
E-business and e-commerce. E-business Infrastructure: Internet technology, Web Technology, Internet-access software applications, Managing e-business infrastructure. E-business Strategy: What is e-business strategy? Strategic analysis, Strategic objectives, Strategy definition, Strategy implementation. Analysis and Design: User-centered site design, Security design for e-business. Social commerce. Analytics and reporting. Search engine optimization. Orders management. Customer Relationship Management. Product management. E-marketing.				

IS3109	Digital Innovation	TH	PRS	PR
Internet Impact on Business: New business forms and models—brokerage, advertising, merchant, on-demand, and utility. Digital Innovation: Digital innovation vs. IT innovation; strategy and digital innovation; digital innovation and business models; digital platform exploitation for business; building digital capabilities; organizational engagement; leveraging crowds for innovation; digital business transformation; characteristics of digital disruptors; validating the value proposition; and conducting competitive research and analysis for innovation. Information Systems Design for the Web: Enterprise Resource Planning, Customer Relationship Management, and Document Management Systems. Networked Applications and Their Impact on Business Processes: E-mail, file sharing, and				

collaboration tools; driving digital innovation using networked applications. User Experience Strategy: Definition of UX strategy—UX design vs. UX strategy, UX strategy vs. business strategy; conducting competitive research and analysis; conducting user research; creating prototypes; and storyboarding. Collecting requirements from any business organization and developing an e-commerce web solution as a group activity.

IS-EAP-2101	Academic English I	TH	-	-
Refer English Curriculum (Page 88 & 89)				

Semester IV				
IS4101	IT Auditing	TH	-	-
IT Audit Overview: Roles of the IS auditor and IS audit functions; auditing and internal control; auditing IT governance controls; auditing operating systems and networks; auditing database systems; computer-assisted audit tools and techniques; business ethics, fraud, and fraud detection; and IT auditing frameworks.				

IS4102	Web Application Development	TH	PRS	-
Server-Side Scripting and Technologies. Client server communication with Scripting Language. Integrated scripting with Data. Sessions and Cookies in PHP. Web development frameworks. Web security. Implementation of Server-Side Scripting Languages.				

IS4103	Operating Systems	TH	PRS	-
Operating Systems Overview (Historical development, Operating system objectives and functionalities, Major achievements). Process & Thread Management (Process concepts, Thread concepts, Descriptions, structures, and controls, Multiprocessors and Multi Thread programming). CPU Scheduling. Concurrency Control (Mutual exclusion, Synchronization, Deadlock, Starvation). Memory Management (Multiprogramming and partitions, Paging and segmentation, Virtual memory, Demand paging, Page replacement algorithms). I/O & File Management (I/O devices, Disk scheduling, File organization, Directory structures). Case Studies. Shell Programming: a) Unix Commands b) Editor Commands c) Unix Shell programming commands a) Concatenation of two strings b) Comparison of two strings c) Maximum of three numbers d) Fibonacci series e) Arithmetic operation using case. System Calls: a) Process Creation b) Executing a command c) Sleep command d) Sleep command using getpid e) Signal handling using kill k) Wait command. Introduction to MIPS Programming with Mars simulation tools-(Exception and interrupt handling).				

IS4104	System Administration and Maintenance	TH	PRS	-
Shell Programming: Unix commands; editor commands; Unix shell programming commands: concatenation of two strings, comparison of two strings, maximum of three numbers, Fibonacci series, and arithmetic operations using the case statement. System Calls: Process creation; executing a command; sleep command; sleep				

command using getpid; signal handling using kill; and the wait command. Introduction to MIPS Programming: Using Mars simulation tools—exception and interrupt handling. Foundation Elements of System Administration: a) Operating Systems: Installation, configuration, maintenance, server services, client services, and support. b) Administrative Activities: Content management and deployment; server administration and management; user and group management; backup management; security management; disaster recovery; automation management; and user support and education. c) Administrative Domains: Web, network, database, OS, and support domains. d) Additional Topics: Introducing system administration on cloud computing and hybrid usage; help desk concepts; system monitoring; and hands-on experience with related latest tools.

IS4105	IT Procurement Management	TH	-	WS
Procurement processes. Procurement documents. Different types of contacts. Procurement negotiation. Procurement performance review. Contract change control systems. National procurement guideline.				

IS4106	Software Architecture	TH	-	-
Basic concepts & principles about software architecture. Introduction to Software Architectural pattern. ADL. 4+1 Architecture. Practical approaches & methods for Create & Analyse software architecture. Quality attributes of software architectures. Examples in architectural design applications & case studies in software architecture (N tier architecture, SOA, Cloud, etc.).				

IS4107	Professionalism & Ethics in Computing	TH	-	-
Role & functions of professional bodies. Professional bodies for computing practitioners. Impact of computing professional bodies on vocational areas of work. Codes of conduct relevant to computing practitioners, Professional integrity and ethics. Duty of computing practitioners in social, political & environmental areas. Computing legislation in the context of job roles for computing practitioners, Other relevant legislation that impacts on computing practitioners. Sources of ethical advice out with professional bodies for computing practitioners. Social, political & environmental computing principles, Ethical conflict resolution.				

IS4108	IS Strategies	TH	-	-
Role of Information Systems in Organizations. An Overview of Strategic Management. Process for Developing Information Systems Strategies. IS Strategic Analysis. Innovating with Technology, Systems & Information. Exploiting Information Systems for Strategic Advantage. Determining the Business Information Systems Strategy. Managing the Portfolio of Business Applications. Justifying & Managing Information Systems Investments. An Organizing Framework for the Strategic Management of IS.				

IS4109	Agile Software Development	TH	-	WS
Plan Driven Development Methodologies Vs Agile Software Development. Agile Manifesto: Values & Principles. Agile Software Development Frameworks. Scrum:				

Roles, Artifacts, Events, Values & Rules. Extreme Programming (XP); Practices, Values & Principles. Lean Software Development: Kanban & Kaizen. Agile Project Management: Planning, Estimation, Communication, Scrum. Agile Testing. Scale up and out in Agile. Agile Tools. Naked objects.

IS4110	Capstone Project	-	-	PR
Study the basic concepts of programming concepts & application to design & implement the mini project intended solution for project-based learning.				

IS-EAP-2201	Academic English II	TH	-	-
Refer English Curriculum (Page 88 & 89)				

Semester V				
IS5101	Entrepreneurship & Innovation	TH	-	WS
Role of entrepreneurs in national development. Training of entrepreneurs. Essential characteristics of techno-entrepreneurs. Business proposal & assessing criteria. Making business proposals. Technology & innovation: Invention, Commercialization & Diffusion, Technology push & market pull. Business models for innovation.				

IS5102	Enterprise Architecture	TH	-	-
An Introduction to Enterprise Architecture (EA). EA Frameworks, Component Architectures. Enterprise Application Service Delivery. Systems Integration. Content Management. Inter-Organizational Architectures. Processes for Developing EA. Architecture Change Management. Implementing EA. EA & Management Controls.				

IS5103	High Performance Computing	TH	PRS	-
Introduction to Parallel & Distributed Programming (definitions, taxonomies, trends). Parallel Computing Architectures, Paradigms, Issues, & Technologies (architectures, topologies, organizations). Parallel Programming (performance, programming paradigms, applications). Parallel Programming Using Shared Memory I (basics of shared memory programming, memory coherence, race conditions & deadlock detection, synchronization). Parallel Programming Using Shared Memory II (multithreaded programming, OpenMP, pthreads, Java threads). Parallel Programming using Message Passing - I (basics of message passing techniques, synchronous/asynchronous messaging, partitioning & load-balancing). Parallel Programming using Message Passing - II (MPI), Advanced Topics (accelerators, CUDA, OpenCL, PGAS). Introduction to Distributed Programming (architectures, programming models). Distributed Programming Issues/Algorithms (fundamental issues & concepts - synchronization, mutual exclusion, termination detection, clocks, event ordering, locking). Distributed Computing Tools & Technologies I (CORBA, JavaRMI). Distributed Computing Tools & Technologies II (Web Services, shared spaces), Distributed Computing Tools & Technologies III (Map-Reduce, Hadoop). Parallel & Distributed Computing				

– Trends & Visions (Cloud & Grid Computing, P2P Computing, Autonomic Computing). Cloud based tool will be used to conduct the practical.

IS5104	Software Process Management	TH	-	-
Project Quality Management - Plan Quality Management, Manage Quality, Control Quality. Project Resource Management - Plan Resource Management, Estimate Activity Resources, Acquire Resources, Develop Team, Manage Team, Control Resources. Project Communications Management - Plan Communications Management, Manage Communications, Monitor Communications. Project Stakeholder Management - Identify Stakeholders, Plan Stakeholder Engagement, Manage Stakeholder Engagement, Monitor Stakeholder Engagement.				

IS5105	Business Process Management	TH	-	-
Business Processes (basic concepts, modeling). Design, analysis, verification & refinement methods. Workflow Systems (organization & architecture). Synchronization, control, communication & monitoring of process enactment. Workflow Analysis. Workflow Patterns. Workflow development tools & software.				

IS5106	UI/UX Practicum	PRS	WS	PR
Identify User Experience Design as a field & how it relates to Computer Science. Distinguish between Human-Centered Computing and Human-Computer Interaction. Design Graphics for computer interfaces. Explore User Experience Design Techniques: scenarios, personas, storyboards, wireframing, information architecture. Explore User Experience Design methods: focus groups, design probes, affinity diagramming, speed dating for UI concepts. Use Prototyping tools (both low-fidelity & high-fidelity). Develop designs for small screens: responsive design, Non-GUI design (e.g., auditory interfaces, gesture interfaces).				

IS5107	Project Management Practicum	-	PRS	PR
Master WBS Creation and Resource Planning: Work Breakdown Structure, Identify Stakeholders, Analyzing Stakeholders. Resource Utilization Planning and Master Schedule Development: Dedicated and Shared Resources, Shared Resource Management, Resource Utilization Planning, Master Schedule.				

IS5108	Business Intelligence	TH	-	-
Decision Support Systems and Business Intelligence: Business Environment Factors (markets, consumer demands, technology, and societal, etc.), Decision Support Frameworks (Degree of Structuredness vs. Types of Control), Automated Decision Making, Evolution of BI Capabilities, DSS & BI Architectures, Styles and Benefits of BI, Elements of a Work Systems, Major Tool Categories for Management Support Systems. Decision Making, Systems, Modeling, and Support: Introduction to Decision-Making Disciplines, Characteristics of Decision Making and Decision Styles, Types and Benefits of Decision-Making Models, Decision-Making Process, New Technologies to Support Decision Making, Key Data Issues and Key Ingredients of Data (Information) Quality Management. Decision Support Systems Concepts, Methodologies, and Technologies: DSS Characteristics and Capabilities,				

DSS Classifications, Major DSS Components and Web Impacts, Future/current DSS Developments. Emerging Trends and Impacts: RFID and BI (RFID for BI in Supply Chain, RFID + Sensors for Better BI, etc.), Reality Mining and Virtual Worlds in BI applications, Web X.0 Revolutions, Virtual (Internet) Communities and Types, Online Social Networking and Social Network Analysis, Implications of Business and Enterprise Social Networks, Cloud Computing and BI, Issues of Legality, Privacy and Ethics. Collaborative Computer-Supported Technologies and Group Support Systems: Why (business) collaboration is difficult? Time/Place Communication Framework, Groupware for (business) collaboration, Group Support Systems and Important Features, GSS Enabling Technologies, Collaborative Planning, Forecasting, and Replenishment (CPFR) and Collective Intelligence, Introduction to Taxonomy of Collective Intelligence.

IS5109	IS Project for Community	-	-	PR
Independent Topics related to Software development will be conducted.				

IS5110	Advanced Database Systems	TH	PRS	-
Database Design & Implementation - Relational Database Design, Database Implementation & Tools, Advanced SQL, Database System Catalog. DBMS Advance Features - Query Processing & Evaluation, Transaction Management & Recovery, Database Security & Authorization. Distributed Databases - Enhanced Database Models, Object Oriented Databases, Database & XML. Emerging Trends & Example of DBMS Architecture - Emerging Database Models, Technologies & Applications, Big data. Advanced SQL - Temporary table, Views, Stored procedures, Stored function & Triggers.				

IS5111	Data Communication & Networks	TH	PRS	-
Fundamental concepts of data communications: Application, Physical, Data Link and Network/Transport layer, Principles of communication and connecting to the network, Network Services. Network Technologies: Local Area Network (LAN) and Wireless LAN. Wireless technologies: Wide Area Network (WAN) and Metropolitan Area Networks (MAN), Internet standards and services. Network Management: Security, Design and Management of the network. Research on data communications and networking. Understand the networking concepts using simulation tools. Hands on experience in the laboratory.				

IS5112	Design Patterns & Anti-patterns	TH	PRS	-
Introduction to Design Patterns: A Brief History, How Design Patterns Solve Design Problems, How to Select & Use a Design Pattern. The Catalog of GoF (Gang-of-Four) Design Patterns. Creational Patterns: Abstract Factory, Factory Method, Singleton. Structural Patterns: Adapter, Composite, Decorator. Behavioral Patterns: Observer, Strategy, Template Method Pattern. Model-View-Controller (MVC) Pattern. Design Principles for creating software that is flexible, reusable, and maintainable. Symptoms of bad design (anti-patterns). Hands on experience in modelling using a UML professional design software and OOP programming.				

IS5113	Software Quality Assurance	TH	PRS	WS
Introduction to Software Quality and Software Quality Assurance (SQA). The components of the software quality assurance system, Software project life cycle components, Infrastructure components for error prevention and improvement, Management SQA components, SQA standards, system certification, and assessment components. Testing Concepts Definition, Types and Levels of testing, Black vs. White Box testing. Test Techniques, White Box techniques, Black Box techniques, Test Planning. Test Design Specifications, Test Cases, Test Metrics, Pre-process metrics: Estimation, In-process metrics: Process Management, End-process metrics: Process Improvement. Test Management, Test planning, resource management, test reporting, tools. Test Automation: Web test automation, Mobile test automation, Test script writing. SQA Standards, certification and assessment. Organizing for quality assurance, Management and its role in software quality assurance. Hands on experience with a SQA Tool for authoring functional tests.				

IS5114	Data Mining & Analytics	TH	PRS	-
Clustering Algorithms: K-mean, Agglomerative algorithm. Classification Algorithms: Decision Tree, Support Vector Machine. Association rule mining. Topic extraction. Implementation of datamining algorithms using python and Weka tools.				

IS-EBP-3101	Business English	TH	-	-
Refer English Curriculum (Page 88 & 89)				

Semester VI				
IS6101	Industrial Training	-	-	PR
Students will be required to complete industrial training related to Information Systems at a relevant industry or research institution. The duration of the project period should be a minimum of 15 weeks. A project report (thesis if it is a research) should be submitted at the end of the semester & should be presented & defended by the respective student in front of an evaluation panel appointed by the department.				

Semester VII				
IS7101	Research Methodologies	TH	-	-
Introduction to the notion of research. Literature review. Research designs. Identifying data requirements, sources, & instruments for data gathering. Undertaking 'experiments'. Validation: Types of validation. Analysing research data. Writing Strategies. Ethical Consideration				

IS7102	Information System Law	TH	-	-
Introduction to Information System Law. Communications Law: Policy and regulation of electronic communications, focusing particularly on the Internet and its most current challenges. Electronic Commerce Law: Legal issues surrounding electronic commerce - including business-to-consumer (B2C), business-to-business (B2B), and consumer to consumer (C2C) forms - and digital applications to support				

the sharing economy, creative processes and the public sector. Information Technology Law: Impact information technology and the Internet have had, and are having, on substantive law. Legal Aspects of Managing Intellectual Property: Intellectual Property Law: Copyright and Related Rights & Industrial Property. Information technology law and Sri Lanka's response-computer and information technology council of Sri Lanka act No. 10 of 1984, computer crime act no 24 of 2007, Electronic transaction act no 19 of 2006 information and communication technology act no. 27 of 2003.

IS7103	Business Process Simulation	TH	PRS	-
Simulation in management decision making. Queuing theory. Concepts of discrete-event simulation. Construction of models: Modeling issues, Verification & Validation of models. Use of computer simulation tools.				

IS7104	Enterprise Modelling Ontologies	TH	PRS	-
Introduction to the Semantic Web. Introduction to Ontologies. Ontology Languages for the Semantic Web. Resource Description Framework (RDF). Lightweight ontologies: RDF Schema. Web Ontology Language (OWL). A query language for RDF: SPARQL. Ontology Engineering. Semantic web & Web 2.0. Applications of Semantic Web. Hands-on experience with Protégé tool.				

IS7105	Organizational Behavior & Management	TH	-	-
Fundamental concepts & overview of Organizational Behavior & Management. Understand Individual Behavior (Attitude, Values, Perception, Learning, Personality. Motivation, Psychological Capital, Multiple Intelligence, Emotional Intelligence). Team dynamics, Planning, Organizing, Leadership, Controlling. Organizational Conflict Management, Stress Management, Interpersonal & Organizational Communication. Organizational Culture & Managing Change.				

IS7106	Cloud Computing	TH	PRS	-
Cloud Computing Concepts: Introduction to cloud computing, Properties, characteristics & disadvantages, Gossip, Membership & Grids, P2P Systems, Key-Value Stores, Time & Ordering Classical Distributed Algorithms. Cloud Systems & Infrastructure: Cloud computing stack, Service model, Deployment models, Containers, virtual machines, MAAS, PAAS, Web Services. Storage: Ceph, SWIFT, HDFS, NAAS, SAN, Zookeeper. Big Data & Applications in the Cloud: Spark, Hortonworks, HDFS, CAP, Streaming Systems, Graph Processing & Machine Learning. Cloud Resource management & Service management in cloud computing. Cloud Networking: Introduction to cloud networking SDN with cloud, Data center networking. Cloud security: Identity & Access management, Access control, Authentication in cloud computing. Developing application in cloud platform, Introduction to Cloud Computing with AWS, Azure Google's cloud platform.				

Research trends in cloud: Edge & Fog computing, cloud & IoT. Hands on experience using a cloud-based tool.

IS7107	Mobile Application Development	-	PRS	WS
Native & Cross-platform Development. Mobile Application Development Languages & Frameworks. Development Tools & Version controlling. Mobile Application Architectures and Design Patterns. Graphics & User Interface Design. Data Persistence, APIs & Libraries, Files & Media. Camera & Motions sensors. GPS/ location sensing & Maps. Network programming. Future Trends (Augmented Reality, M-Commerce, Low Code Development). Security, & Marketplace deployment.				

IS7108	Web Service Technologies	TH	PRS	-
Introduction to SOA. Communication Protocols: RESTFul services, SOAP services (WS-* protocols). Serialization Formats: XML (XML Schema, XPath & XSLT), JSON, Text Encoding Formats, Binary Formats (Protobuf). Web services with tools (Postman). Security: OAuth, JWT, SWT, Distributed Web applications development using a Java Web Framework. Implementation of web services.				

IS7109	Geographical Information Systems	TH	PRS	-
Introduction to GIS - What is Geographic Information Systems, Different components of GIS, Different types of vector data, Raster data models & their types, TIN data model. Data Representations - Advantages & disadvantages associated with vector, raster & TIN, Non-spatial data (attributes) & their type, Raster data compression techniques, Different raster data file formats, Spatial database systems & their types. Map Projections - Pre-processing of spatial datasets, Different map projections, Spatial interpolation techniques, Different types of resolutions, Digital Elevation Model (DEM). Geographic Phenomena. Hands on experience with GIS. Hands on experience with different spatial related APIs (Geo Coding API, LocationIQ API, Google Maps API etc.).				

IS7110	Statistical Distribution & Inferences	-	PRS	-
Probability distributions - Normal distribution, Poisson distribution, exponential, distribution, binomial distribution etc. An overview of statistical inference. An introduction to statistical inference. Sampling Distributions - Statistical inference: Estimation of population parameters based on the data obtained through a suitable sample. Sampling distribution: The probability distribution of a particular statistic of an obtained sample. Estimation - Approximation of values for a particular parameter. Hypothesis testing - Evaluation of a particular assumption made. Correlation & simple linear regression analysis - Correlation: Measuring the strength of the association between the independent & the dependent variables. Simple linear regression: measuring the relationship between the independent & the dependent variable.				

IS7111	Advanced Programming Practicum	-	PRS	-
Advanced programming features available in OOP languages: Model-View-Controller & design patterns, multithreading, exception handling, file handling & file I/O, abstract classes & interfaces, collections framework, event driven programming model & Java layout managers for GUI design, various categories of design patterns including but not limited to Behavioral Patterns, Creational Patterns & Structural Patterns. The emphasis will be on design, implementation & testing of object-oriented solutions to a specified problem using above techniques. Choosing an appropriate design pattern for a particular situation.				

IS7112	Machine Learning	TH	PRS	-
Introduction to machine learning & neural networks: supervised learning, linear models for regression, basic neural network structure. Deep learning. Neural networks: Forward Propagation, Cost Functions, Error Backpropagation, training by gradient descent, bias/variance & under/ overfitting, regularization, Exercises on NNs, solving a problem with NNs on TensorFlow. Exercises on CNN, solving a problem with CNN on TensorFlow. Exercises on RNNs, solving a problem with RNNs on TensorFlow.				

Semester VIII				
IS8101	Research Project in IS	-	-	THS
The course starts with a reflection and discussion about interdisciplinary research, where students define their research topics. Throughout the course, the students work in developing their research questions and choose the appropriate methodological approaches for their research and analyze the results. Students should be able to provide valid findings in selected research domains and report in a format of thesis and submit it to the department. They are encouraged to present their findings in local and international research forums.				

IS8102	Business/IT Alignment	TH	-	-
IT Solutions in Organizations. Frameworks for the Analysis of IT Solutions in Organizations. Business-IT Alignment - Theoretical Background and Hypotheses Formulation. Business-IT Alignment - Empirical Research. Roadmaps for Business-IT Alignment (Models).				

IS8103	Human Resource Management	TH	-	-
Uniqueness of Human Resource, Human Resource Management, Purpose of HRM, Importance & Responsibility for functions of HRM, Jobs, job designing & Job analysis. The necessity for Job re-designing, Job redesigning methods, Alternative work schedules. Value of Job Analysis, Job Description & Job Specification, HR Planning, HR Planning Process Recruitment & process of recruitment, Employer branding, New trends in recruitment – Active Sourcing/SNS recruitment. Significance of employee selections, Selection methods & selection process, Errors in employee selection Process of hiring, Probationary period, Employee orientation. Definition of Employee Performance Evaluation (EPE), Significance of EPE, EPE methods, Developing PE system. Definition–Learning, Education, training,				

development, Learning Principles, Training needs analysis. Training programme designing, Effective implementation of training Programmes, Evaluation of training programmes. Reward & total reward, Basic Salary determination - Job evaluation, Pay survey, Performance based pay, Employee benefits, Legal provisions for reward management in Sri Lanka. Grievance Handling (GH), Importance of GH, Methods of GH, Practical tips in HG. Discipline management, Hot Stove Model, Misconducts, Domestic Inquiry. The concepts of occupational health & safety, Hazards & factors affecting health & safety, Interventions for improving health & safety. Human Resource Information Systems. Green HRM, HR Analytics, HR Scorecards.

IS8104	Scientific Communication	TH	-	-

The nature of scientific writing: the scientific paper as an argument. Writing proposals: kinds of proposals, standard formats for proposals, and strategies for making the proposal persuasive. Writing lab reports, project reports, and journal articles; standard formats for research reports; and principles of structuring the report. Strategies for presenting data logically and persuasively. Writing abstracts: kinds of abstracts, structuring the abstract, and strategies for making the abstract concise, specific, and detailed. Academic writing: research significance, flow, making claims, and the argumentation model. Maintaining objectivity; using jargon; and presenting equations. Rhetorical principles and conventions of presenting data graphically. Documenting the scientific paper. Presenting scientific material to a lay audience. Ethics and plagiarism.

IS8105	IS Economics	TH	-	-

Economic Aspect of Information & Information Systems. Problem of Asymmetric Information: Adverse Selection & Moral Hazard. Macroeconomic & Microeconomic Aspects of Information Systems. Basic Economic Principles on Firms, Markets, Industries & Organization; Demand & Supply Analysis. Economic Impacts of Telecommunication & Digital Media. Sustainable Development & Information Technology. Intellectual Property Rights & Knowledge Based Economy. The Impact of Information Systems on Employment /Unemployment. Pricing & Marketing of Information Goods.

IS8106	Computer System Security	TH	PRS	-

Threats and attacks on security; crypto basics; symmetric key cryptography; public-key cryptography; key distribution and hash functions. Authentication: biometric methods. Authorization: access control. Simple authentication protocols and real-world security protocols; wireless network security; operating system security; software security; and network management security. Hands-on experience with related latest tools.

IS8107	Supply Chain Management	TH	-	-

Overview of Supply Chain Management. Integrated Supply Chain Management. Procurement Management, Inventory Management & Manufacturing. Packaging & Handling, Distribution & Warehouse Management. Transportation. Supply Chain Logistics Planning & Design. Global Supply Chains & Network Design. Performance Measurement, Risk & Security Management.

IS8108	Advanced Computer Networks	TH	PRS	-
Device to Device Communication Architectures - Algorithm & protocols designed for MANET, mesh, cellular & opportunistic networks. Students will read several classic research papers to understand the design choices & vision. Content based Network Architectures - Principles of data dissemination, aggregation & caching that are applied to sensor networks, Internet of Things & other content-based paradigms. Students will survey recent research publications on opportunistic networks & next generation content-based networking ideas. Applications - P2P, Social Networks, Cloud computing applications will be discussed for the IP network & similar applications for next generation networks. These discussions will be mainly led by students & moderated by the instructor. Simulation & Experimentation - Introduction to performance analysis of new networking ideas using the Network Simulator -v3 (ns3), Click Modular Router & the GENI testbed. Students will complete lab exercises that demonstrate various capabilities of the aforementioned tools. Hands on experience with related latest tools.				

IS8109	Process Mining	TH	PRS	-
Introduction to Process Mining. Process Modeling & Analysis. Getting the Data. Process Discovery: Advanced Process Discovery Techniques Conformance Checking. Mining Additional Perspectives. Operational Support. Tool Support. Hands on experience with related latest tools.				

IS8110	Digital Business Model	TH	-	-
Introduction to Digital Business Models. How Internet companies use digital business models. Key actors and stakeholders in the digital economy. The emergence of new digital spaces and business models. Adopting digital business models and disrupting established market sectors. Developing digital business models that capture value and sustain their competitive advantage. Build your own Digital Business Model.				

IS8111	Game Development	TH	PRS	-
A brief history of video games; games and society; game design (with 3D characters: animation and control); teams and processes in games; programming fundamentals for game development; debugging games; game architecture; memory and I/O systems in game development environments; mathematical concepts for games; collision detection and resolution; graphics for games; artificial intelligence in games; networks and multiplayer mode for games; UI development; connecting games to services and databases; and global illumination and code libraries. This module's laboratory sessions are covered by using a suitable gaming library to develop simple gaming applications based on a given scenario.				

Rules and Regulations

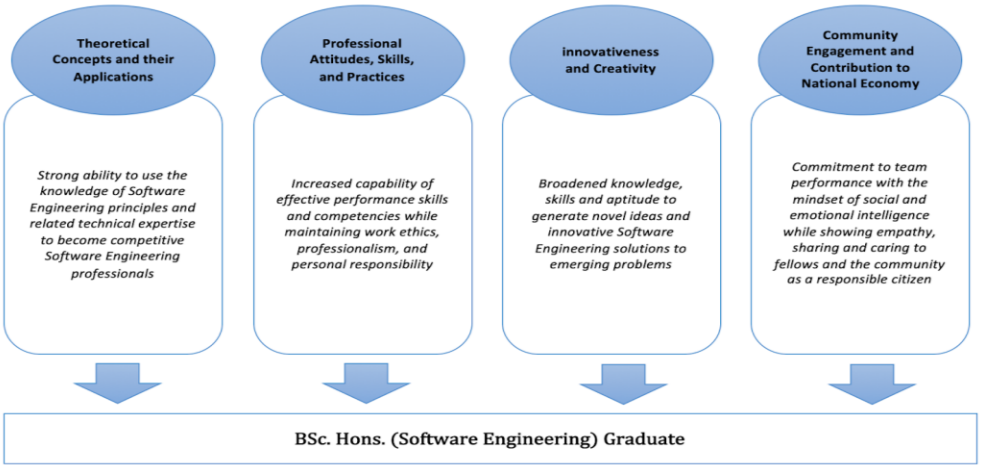
1. Students should complete (obtain at least D+ grade) for the Compulsory, Credited, Non-GPA courses: Academic Integrity, Communication Skills I, Communication Skills II, General English I, General English II, Academic English I, Academic English II, and Business English to be eligible for the award of the BScHons (Inf Sys) Degree.
2. Students should follow at least courses which are not less than total credits of six (06) out of ten (10) credits elective courses in the Semester V.
3. Students should follow at least courses which are not less than total credits of four (04) out of nine (09) credits elective courses in the Semester VII.
4. Students should follow at least courses which are not less than total credits of four (04) out of nine (09) credits elective courses in the Semester VIII.
5. Elective courses will be conducted in the Semester V, VII and VIII, depending on the availability of the resources.
6. Compulsory, Non-Credited Industrial Visit will be organized during the Semester V.
7. Students should go for the Industrial Training in the Semester VI, which is compulsory for all. Also, students should submit Internship Placement Offer Letter to the Department prior to the commencement of Semester VI.
8. Students must complete both the Capstone Project and the Information Systems Project for Community, in accordance with the established guidelines. Final reports must be submitted by the specified deadlines.
9. Students should submit the Research Proposal for the Final Year Research Project in Information Systems during the first part of the semester VII through the course IS7101 Research Methodologies. Upon approval, the Research will commence and continue with regular progress presentations from Semester VII until the end of the Semester VIII. This project is completely a research project and is not an industry internship.

DEPARTMENT OF SOFTWARE ENGINEERING

Degree Programme

Bachelor of Science Honours in Software Engineering [BScHons (SE)]

Graduate Profile



Guidelines for course codes and credits

- Each course code consists of four digits together with the prefix (alphabet letters)
- Prefix alphabet letters denote the abbreviation to the name of degree Programme (SE)
- The first digit of each course code is the corresponding semester of study (1-8).
- Second digit represents the revision of the subject and it will increment if the subject is revised.
- Third and fourth digits represent the subject code

Example: The course code of SE1101 denotes the following;

Abbreviated name of degree Programme	Semester	Revision Number	Subject Code
SE (Software Engineering)	1	1	01

Note: There are no spaces or special characters in the course code.

Summary of the Courses

Table 1: Courses offered in the Semester I			
Course Code	Course Title	No of Credits	Compulsory or Elective
SE1101	Computer Organization	2	Compulsory
SE1102	Programming Fundamentals	2	Compulsory
SE1103	Requirements Fundamentals	2	Compulsory
SE1104	Software Process Concepts	2	Compulsory
SE1105	Social and Professional Issues	2	Compulsory
SE1106	Fundamentals of Mathematics	2	Compulsory
SE1107	Fundamentals of Statistics	2	Compulsory
SE1108	Communication Skills I	2	Compulsory (Non-GPA)
SE1109	Academic Integrity	1	Compulsory (Non-GPA)
SE-EGP-1101	General English I	2	Compulsory (Non-GPA)
	Total	19	

Table 2: Courses offered in the Semester II			
Course Code	Course Title	No of Credits	Compulsory or Elective
SE2101	Algorithms, Data structures, and Complexity	2	Compulsory
SE2102	Database Management Systems	2	Compulsory
SE2103	Operating Systems Basics	2	Compulsory
SE2104	Object Oriented Programming	2	Compulsory
SE2105	Requirement Specification and Documentation	2	Compulsory
SE2106	Software Process Implementation	2	Compulsory
SE2107	Analysis Fundamentals	2	Compulsory
SE2108	Advanced Mathematics	2	Compulsory
SE2109	Communication Skills II	2	Compulsory (Non-GPA)
SE-EGP-1201	General English II	2	Compulsory (Non-GPA)
	Total	20	

Table 3: Courses offered in the Semester III			
Course Code	Course Title	No of Credits	Compulsory or Elective
SE3101	Network Protocols	2	Compulsory
SE3102	Formal Methods	2	Compulsory

SE3103	Object Oriented Analysis and Design	2	Compulsory
SE3104	Requirements Validation	2	Compulsory
SE3105	Software Design Concepts	2	Compulsory
SE3106	Web Systems and Technologies	2	Compulsory
SE3107	Software Engineering Foundations	2	Compulsory
SE-EAP-2101	Academic English I	2	Compulsory (Non-GPA)
	Total	16	

Table 4: Courses offered in the Semester IV			
Course Code	Course Title	No of Credits	Compulsory or Elective
SE4101	Security Fundamentals	2	Compulsory
SE4102	Software Verification and Validation	2	Compulsory
SE4103	Software Configuration Management	2	Compulsory
SE4104	Software Project Management	2	Compulsory
SE4105	Human Computer Interaction Design	2	Compulsory
SE4106	Projects in Web Systems and Technologies	3	Compulsory
SE4107	Industrial Inspection	1	Compulsory
SE4108	Risk Management	2	Compulsory
SE4109	Communication Skills	2	Compulsory
SE4110	Management Information Systems	2	Compulsory
SE-EAP-2201	Academic English II	2	Compulsory (Non-GPA)
	Total	22	

Table 5: Courses offered in the Semester V			
Course Code	Course Title	No of Credits	Compulsory or Elective
SE5101	Computer and Network Security	2	Compulsory
SE5102	Software Testing	2	Compulsory
SE5103	Product Assurance	2	Compulsory
SE5104	Mini Project	3	Compulsory
SE5105	Evolution processes and activities	1	Compulsory
SE-EBP-3101	Business English	2	Compulsory (Non-GPA)
Students should select courses covering 04 Credits from the following elective courses			
SE5106	IT Auditing	2	Elective
SE5107	Human Resource Management	2	Elective
SE5108	Geographic Information Systems	2	Elective
SE5109	Logistic System and Transportation	2	Elective

	Management		
SE5110	Business Intelligence	2	Elective
	Total (Compulsory + Electives)	16	

Table 6: Courses offered in the Semester VI			
Course Code	Course Title	No of Credits	Compulsory or Elective
SE6101	Community Project	3	Compulsory
SE6102	Cloud Computing	2	Compulsory
SE6103	Parallel and Distributed Systems	2	Compulsory
SE6104	Advanced Database Management Systems	2	Compulsory
SE6105	Software Architecture	2	Compulsory
SE6106	Software Design Patterns	2	Compulsory
SE6107	Software Design Evaluation	2	Compulsory
SE6108	Current Topics in Software Engineering	1	Compulsory
Students should select courses covering 04 Credits from the following elective courses			
SE6109	Enterprise Modeling Ontologies	2	Elective
SE6110	Software Engineering Economics	2	Elective
SE6111	Social Computing	2	Elective
SE6112	Semantic Web	2	Elective
SE6113	Robotics	2	Elective
	Total (Compulsory + Electives)	20	

Table 7: Courses offered in the Semester VII			
Course Code	Course Title	No of Credits	Compulsory or Elective
SE7101	Industrial Training	6	Compulsory
	Total	6	

Table 8: Courses offered in the Semester VIII			
Course Code	Course Title	No of Credits	Compulsory or Elective
SE8101	Research Project	8	Compulsory
SE8102	Research Methods	2	Compulsory
SE8103	Service Oriented Architecture	2	Compulsory
SE8104	Problem Analysis and Reporting	2	Compulsory
SE8105	Machine Learning	2	Compulsory
SE8106	Mobile Computing	2	Compulsory
SE8107	Refactoring	2	Compulsory
Students should select courses covering 04 Credits from the following elective courses			
SE8108	Game Designing and Development	2	Elective
SE8109	Data Mining	2	Elective

SE8110	Big Data Analytics	2	Elective
SE8111	Artificial Intelligence	2	Elective
	Total (Compulsory + Electives)	24	

Summary of Credits Required

	Semester I	Semester II	Semester III	Semester IV	Semester V	Semester VI	Semester VII	Semester VIII
Credited and Compulsory courses	14	16	14	20	10	16	06	20
Credited and Elective courses	-	-	-	-	04	04	-	04
Credited, Compulsory and Non-GPA Courses	05	04	02	02	02	-	-	-
Total credits	39		38		36		30	
Total credits for the degree programme	143							

Detailed Syllabus

N.B.

TH - Theory
PRS - Practical
IFV - The department organizes the field visit relevant to the particular subject area.
WS - The department organizes workshops relevant to a particular course unit.
PR - Project Report
THS - Thesis

Semester I				
SE1101	Computer Organization	TH	PRS	-
Basic Concept and Computer evolution: Organization and Architecture, the evolution of the Intel x86 Architecture, Embedded Systems, ARM architecture. Computer Performance Issues: Multicore, MIC and GPGPUs, Basic Measures of Computer Performance, benchmark and SPEC. Computer Function and interconnection: Computer Bus Interconnection, Point to Point Interconnection. Computer Memory System: Cache Memory Principles, Semiconductor main memory, External memory. Input/output: External Devices, I/O Modules, Interrupt Driven I/O, Programmed I/O, I/O channels and processors, External Interconnection Standards. Arithmetic and Logic: number system, Integer Representation, Floating Point representation, Digital logic, Combinational Circuits, Sequential Circuits, Programmable Logic Devices. The central Processing Unit: Machine Instruction Characteristics, Addressing Modes, Assembly language, Processor, Instruction Level Parallelism and superscalar Processor. Parallel Organization: Parallel processing, Multicore computers, General purpose Graphic processing Unit. Practical using graphical simulation tool for designing and simulating logic circuit. Digital Logic Design Implementation and Simplification of Boolean Functions Combinational Logic Modules – Adders and Subtractors Sequential logic, flip flops, FSM analysis and design Introduction to Assembly Language Programming.				

SE1102	Programming Fundamentals	TH	PRS	-
Introduction to Programming: Introduction to compilers & interpreters, Data types, Variables, Expressions & Assignment Statements, Console Input/Output, Libraries & Namespaces. Flow Control: Branching Mechanisms, Loops. Function Basics: Predefined Functions, User-Defined Functions, Scope Rules. Parameters: Parameters, Default Arguments. Arrays: Introduction to Arrays, Array manipulation, Multidimensional Arrays. Pointers: Introduction to pointers, Pointer arithmetic. Recursion: Recursive functions. Exception Handling: Testing & Debugging. File Reading & Writing. Write programmes using functions, parameter passing, choose appropriate conditional & iteration constructs for a given programming task. Write programmes using arrays, standard conditional & iterative structures & pointers. Demonstrate the concept of recursion by examples, identify the base case & the general case of a recursively-defined problem. Demonstrate file handling & exception handling. Identify & describe uses of Data				

types, Variables, Expressions & Assignment Statements, Console Input/ Output and Libraries. Modify & expand short programmes that use standard conditional & iterative control structures. Write programmes using functions, parameter passing, choose appropriate conditional & iteration constructs for a given programming task. Write programmes using arrays, standard conditional & iterative structures & pointers. Demonstrate the concept of recursion by examples, identify the base case & the general case of a recursively-defined problem. Demonstrate file handling & exception handling.

SE1103	Requirements Fundamentals	TH	-	-

Definition of requirements: Product, Project, Constraints, System boundary, External and Internal. Requirements process: Layers/levels of requirements (e.g., needs, goals, user requirements, system requirements, and software requirements. Requirements characteristics: Testable, Unambiguous, Consistent, Correct, Traceable, and Priority. Analyzing quality (non-functional) requirements: Safety, Security, Usability, and Performance. Software requirements in the context of systems engineering. Requirements evolution: Traceability, Prioritization, Trade-off analysis, Risk analysis, and Impact analysis. Requirements management: Consistency Management, Release Planning, and Reuse. Interaction between requirements and architecture.

SE1104	Software Process Concepts	TH	-	-

Introduction to software process. Themes and terminologies of software process and the concepts. Introduction and applications of software engineering process infrastructure. Detail view of modelling and specification of software process. Quality analysis control: Defect prevention, Review process, Quality metrics and root cause analysis of critical defects. Introduction to systems engineering model life cycle.

SE1105	Social and Professional Issues	TH	-	-

History of computing. Social context of computing. Methods & tools of analysis: Consequence, Duty and right based ethical theories. Professional & ethical responsibility. Risks & liability of computer-based systems. Intellectual property, privacy & civil liberties. Computer crime, customs & law. Economic issues in computing. Philosophical frameworks.

SE1106	Fundamentals of Mathematics	TH	-	-

Linear Algebra. Matrices, Vector spaces & subspaces. Linearly independent & dependent vectors, Dimension rank & the basis of vector spaces. Linear transformations, Systems of linear equations, Determinants. Diagonalization of matrices, Functions & relations. Sets, cardinality Cartesian product. Ordered pairs, Bijective mappings, Equivalence relations. Logic Propositions, Truth tables, Symbolic statements, Disjunctive & conjunctive normal forms. Karnaugh maps.

SE1107	Fundamentals of Statistics	TH	-	-
Probability: Venn diagrams, Tree diagrams & Cartesian diagrams, Conditional Probability - The occurrence of an event given that another event has already occurred, Bayes' theorem & applications - An extension of conditional probabilities, Statistics: Population & Sample - Population: all the objects that a person is interested in, Sample: a subset of the population which is used to make inferences about the population, Types of random variables - Discrete & continuous random variables, Data Collecting - Experimental studies & observational studies, Data Summarizing Techniques - Descriptive statistics: mean, median, mode, inter quartile range, standard deviation etc., Data Visualizing Techniques - Techniques to visualize continuous & discrete variables, Measure of Central tendency - Mean, median, mode, Measure of Dispersion - Standard deviation, variance & inter quartile range, Mean & Variance of Random Variables - Relationship between the mean & the variance of random variables.				

SE1108	Communication Skills I	TH	-	-
Introduction to Communication: Purpose of Communication; Process of Communication; Importance of Communication in Business; Differences between Technical and General Communication; Barriers to Communication; Measures to Overcome the Barriers to Communication, Types of Communication: Types of Communication; Verbal Communication-Importance of verbal communication-Advantages of verbal communication- Advantages of written communication; Significance of Non-verbal Communication, Listening Skills: Listening Process; Classification of Listening; Purpose of Listening; Common Barriers to the Listening Process; Measures to Improve Listening; Listening as an Important Skill in Workplace, Language for Communication: Language and Communication; General Principles of Writing; Improving Writing Skills; Essentials of good style; Expressions and words to be avoided; Grammar and Usage, Communication in Organizations: Internal Communication; Stakeholders in Internal Communication; Channels of Internal Communication; External Communication; Stakeholders in External Communication; Channels of External Communication, Communication Network: Scope and Types of Communication Network; Formal and Informal Communication Network; Upward Communication; Downward Communication; Horizontal Communication; Diagonal Communication, Writing Business Letter: Importance of Business Letters; Difference between Personal and Business Letters; Structure and Format of Business Letters; Types of Business Letters.				

SE1109	Academic Integrity	TH	-	-
Introduction to academic integrity, Academic integrity policies, Plagiarism, collusion and contract cheating, putting academic integrity into practice, Research ethics, Citing and referencing, Reading and Note-making, Critical Thinking				

SE-EGP-1101	General English I	TH	-	-
Refer English Curriculum (Page 88 & 89)				

Semester II				
SE2101	Algorithms, Data structures, and Complexity	TH	PRS	-
Primitive data types: arrays, structures, pointers, memory allocation, iteration & recursion. Singly & doubly linked lists. Stack and Queue. Trees, binary search trees & basic operations. Hash tables. Graphs & basic algorithms on graphs: depth first & breadth first search, Dijkstra's algorithm. Sorting algorithms: quick sort, bubble sort, selection sort, merge sort, tree Sort. Complexity analysis of algorithms. Hands on experience on data structures & algorithms.				

SE2102	Database Management Systems	TH	PRS	-
Introduction to Databases: Definition of the database, database system, data models, database applications. Database system architecture, characteristics of database approaches. Database development process. Data models. Relational model. ER model. Schema Mapping. Designing: Logical design: Relational database model, Logical view of data, keys, integrity rules, Normalization. Relational algebra: Introduction, Selection & projection, set operations, renaming, Joins, Division, syntax, semantics, Operators, Grouping & ungrouping, relational, Triggers. Database Management tools: Installation and Setting up the environment. Create Databases & Tables, Modifying Databases & Tables. Inserting Table Data, Modifying Table Data. Querying Data. Functions (String Functions, Date & time functions, Numeric Functions, Aggregate Functions). Joining Tables (Querying Multiple Tables, Joining Tables with SELECT, Table Name Aliases, Inner Joins, Outer Joins).				

SE2103	Operating Systems Basics	TH	PRS	-
Operating Systems Overview (Historical development, Operating system objectives and functionalities, Major achievements). Process & Thread Management (Process concepts, Thread concepts, Descriptions, structures, and controls, Multiprocessors and Multi Thread programming). CPU Scheduling, Concurrency Control (Mutual exclusion, Synchronization, Deadlock, Starvation). Memory Management (Multiprogramming and partitions, Paging and segmentation, Virtual memory, Demand paging, Page replacement algorithms). I/O & File Management (I/O devices, Disk scheduling, File organization, Directory structures). Case Studies. Shell Programming: a) Unix Commands b) Editor Commands c) Unix Shell. programming commands a) Concatenation of two strings b) Comparison of two strings c) Maximum of three numbers d) Fibonacci series e) Arithmetic operation using case, System Calls a) Process Creation b) Executing a command c) Sleep command d) Sleep command using getpid e) Signal handling using kill f) Wait command, Introduction to MIPS Programming with Mars simulation tools-(Exception and interrupt handling).				

SE2104	Object Oriented Programming	TH	PRS	-
Fundamentals of Object-Oriented Programming; Classes & Objects. Data Abstraction. Information Hiding & Encapsulation. Methods: Void methods, return methods, argument passing. Inheritance. Polymorphism: Method overloading and method overriding. Abstract Classes. Exception Handling. Files & Database				

connections. Installation & configuring an IDE for OOP language: setting up path, environmental variable. Implement Class, Objects, Variables, Identifiers, Keywords, Data types. Arithmetic/logical Operators, Demonstrate Control statement (If-else, Switch), Loops (while, do-while, for). Implementation of Arrays. Implementation of Methods, Passing parameters, Arguments, Constructors. Implementation of OOP Concepts: Abstraction, Encapsulation, Inheritance (Specialization and Generalization) and Polymorphism. Applications of OOP concepts to solve real life problems.

SE2105	Requirement Specification and Documentation	TH	-	-

Requirements documentation basics (e.g., types, audience, structure, quality, attributes, and standards). Software requirements specification techniques (e.g., plan driven requirements documentation, decision tables, user stories, and behavioural specifications). Requirement Documentation tools and techniques.

SE2106	Software Process Implementation	TH	-	-

Levels of process definition (e.g., organization, project, team, and individual). Life-cycle model characteristics (e.g., plan-based, incremental, iterative, and agile). Individual software process (model, definition, measurement, analysis, and improvement). Team process (model, definition, organization, measurement, analysis, and improvement). Software process implementation in the context of systems engineering. Process tailoring. Effect of external factors (e.g., contract and legal requirements, standards, and acquisition practices) on software process. Software process implementation techniques.

SE2107	Analysis Fundamentals	TH	-	-

Regression Analysis: Simple linear regressions and multiple linear regressions, parameter estimation (OLS) and its properties, tests for regression coefficients, tests for significance of the fitted model (ANOVA), model adequacy checking and remedial measure, Models with qualitative independent variables (Dummy variables) and model selection procedures. Nonparametric statistical methods: Scale of Measurements, Single sample tests; Sign and Wilcoxon Signed Rank Test, Two Sample tests. Wilcoxon Matched Paired Signed Rank test, Wilcoxon Rank Sum Test, The Kruskal-Wallis One-Way Analysis of Variance by Ranks, and Friedman Two-Way Analysis of Variance by Ranks, Rank Correlations (Spearman's and Kendall Tau). Introduction to time series analysis and Forecasting; Components of Time Series data, Smoothing methods, Forecasting methods. Analysis of real-world data using statistical software and interpretation of results.

SE2108	Advanced Mathematics	TH	-	-

Functions & relations - relations: an association between two or more sets. Functions: a binary relation. Sequences - An enumerated collection of objects in which repetitions are allowed & order does matter. Series - The addition or multiplication of multiple quantities. Errors Numerical Solution of Nonlinear Equations. Interpolation Theory - The theory of estimating data points within a known data set. Numerical solution of systems of Linear Equation. Numerical

Differentiation & integration. Numerical methods for differential equations. Graph theory.

SE2109	Communication Skills II	TH	-	-
Writing Memos Circulars and Notices: What is a Memo?- Principles of précis writing- Approaches to memo writing- Characteristics of a memo- Guidelines for writing memos- Language and writing style of a memo- Format of a Memo; Circulars- Guidelines for writing a circular- Languages and writing style of a circular- Format of a circular; Notices- Purpose- Format- Important points to remember while writing a notice, Report Writing: Features of Writing a Good Report; Purpose of Report Writing; Difference between Business Report and Engineering Report-Characteristics of writing a good report-Importance of communication in report writing; Guidelines for Report Writing; Steps in Report Writing; Structure of Report; Types of Reports and Different Formats, Writing E-mail: Principles of E-mail; E-mail Etiquette; Overcoming Problems in E-mail Communication, Oral Communication Skills: Oral Business Presentation- Purpose –Audience-Locale; Steps in Making a Presentation- Research and planning-Structure and style-Preparation –Presentation; Delivering a Presentation, Meetings: Types of Meetings; Importance of Business Meetings; Different Types of Business Meetings; Conducting Meetings-Selecting participants-Developing agendas-Opening meetings-Establishing ground rules for meetings-Time management-Evaluations of meeting process-Evaluating the overall meeting-Closing meetings; Common Mistakes Made at Meetings, Reading Skills: Reading Skill; Purpose of Reading; Types of Reading; Techniques for Effective Reading, Employment Communication – Resume: Contents of Good Resume; Guidelines for Writing Resume; Different Types of Resumes; Reason for a Cover Letter to Apply for a Job-Format of Cover Letter; Different Types of Cover Letters, Employment Communication – Job Interview: Importance and Factors Involving Job Interview; Characteristics of Job Interview; Job Interview Process; Job Interview Techniques-Manners and etiquettes to be maintained during an interview; Sample Questions Commonly asked During Interview			

SE-EGP-1201	General English II	TH	-	-
Refer English Curriculum (Page 88 & 89)				

Semester III				
SE3101	Network Protocols	TH	PRS	-
Data Transmission Concepts: Channel Model, Synchronization and Baseband encoding, multiplexing. Packet Network Architectures: Packet switching. Network topologies: Bus, Star, Ring, and Types of networks. Layered Architecture. Internet Protocol Suite: Introduction, Transport Layer protocols, IP support protocols, Application Layer Protocols, IPV4 and IPV6 and QoS. Local Area Networks: Conventional LAN Architectures, IEEE 802 MAC layer standards, Wireless LANs. Wireless interconnection devices: Hub, Router, and Bluetooth (802.15) wireless personal area network. Mobile Wide Area Networks: introduction to wireless network, 2Infrastructure based and ad hoc mode networking in wireless networks,				

CDMA, Mobility in Wide area networks. Network Design: cabling standards: CAT5, CAT5e etc. Virtual LANs provisioning on switched networks, Virtual Private Networks service provision by service providers, IP NAT and proxy provision. Last mile access solutions (e.g., xDSL, FTTH). Miscellaneous topics: Content Distribution Networks, Software defined networks (SDN), Internet of Things. Network Protocol practice.

SE3102	Formal Methods	TH	-	-
Hoare Logic and Programme Verification: classical logic, induction and recursion, Programme semantics, rewriting, reactive systems, temporal logic, model checking, and abstraction. Temporal Logic and Model Checking: Build reliable software, hardware, and security protocols. Various tools, including theorem proving and model checking tools, and will work in groups to apply the tools to various domains.				

SE3103	Object Oriented Analysis and Design	TH	PRS	-
Managing design complexity with OOAD. Evolution of the object-oriented paradigm. Classes & Objects: Associations, Aggregation, Inheritance; Polymorphism, Abstraction, Encapsulation. Unified process, Notation: Unified Modeling Language. Use Case Diagram. Class Diagrams. Sequence Diagrams. Activity and component diagrams. Behavioral State Machine Diagrams. OOAD in Agile. Hands on experience using CASE tools.				

SE3104	Requirements Validation	TH	-	-
Reviews and inspections. Prototyping to validate requirements. Acceptance test design. Validating product quality attributes. Requirements interaction analysis (e.g., feature interaction). Formal requirements analysis.				

SE3105	Software Design Concepts	TH	-	-
Definition of design. Fundamental design issues (e.g., persistent data, storage management, and exceptions). Context of design within multiple software development life cycles. Design principles (information hiding, cohesion, and coupling). Interactions between design and requirements. Design for quality attributes (e.g., reliability, usability, maintainability, performance, testability, security, and fault tolerance). Design trade-offs.				

SE3106	Web Systems and Technologies	TH	PRS	-
Introduction to SOA. Communication Protocols: RESTFul services, SOAP services (WS-* protocols). Serialization Formats: XML (XML Schema, XPath & XSLT), JSON, Text Encoding Formats, Binary Formats (Protobuf). Web services with tools (Postman). Security: OAuth, JWT, SWT, Distributed Web applications development using a Java Web Framework. Implementation of web services.				

SE3107	Software Engineering Foundations	TH	PRS	-
Introduction to engineering methodologies. Requirement engineering. System specification. System modeling. System architecture. System implementation. System testing. Software maintenance. Project management. Hands on experience in Software Engineering Foundations tools and techniques.				

SE-EAP-2101	Academic English I	TH	-	-
Refer English Curriculum (Page 88 & 89)				

Semester IV				
SE4101	Security Fundamentals	TH	-	-
Fundamental aspects of security: CIA, security mindset, design principles, system/security life cycle. Security Implementation Mechanisms (Guards, Gates, Cryptography, steganography). Information Assurance Analysis Models (Threats, Vulnerabilities, Attacks, Countermeasures). Disaster and Recovery. Security Mechanisms: Cryptography, Authentication, Redundancy, Intrusion Detection. Operational Issues: Trends, Auditing, Cost-Benefit analysis, Asset Management, Standards, Enforcements, Legal Issues. Policy: Creation & Maintenance of Policies, Prevention, Avoidance, Domain, Integration. Attacks: Social Engineering, Denial of Service, Protocol Attacks, Active & Passive Attacks, Buffer Overflow Attacks, Malware. Forensics: Legal Systems, Digital Forensics, Rules of Evidence, Search & Seizure, Digital Evidence, Media Analysis.				

SE4102	Software Verification and Validation	TH	-	-
V&V terminology and foundations. V&V objectives and constraints. Planning the V&V effort. Documenting V&V strategy, including tests and other artifacts. Metrics and measurement (e.g., reliability, usability, and performance). V&V involvement at different points in the life cycle. Reviews and static analysis, Personal reviews (design, code, etc.), Peer reviews (inspections, walkthroughs, etc.). Static analysis (common defect detection, checking against formal specifications, etc.)				

SE4103	Software Configuration Management	TH	-	-
Revision control. Release management, Configuration management tools, Build processes and tools, including automated testing and continuous integration, Software configuration management processes, Maintenance issues, Distribution and backup.				

SE4104	Software Project Management	TH	-	-
Introduction to Software Project Management: Projects and Processes, The Process Framework, Project integration Management, Scope Management, Time Management, Project cost Management, Quality management, Human Resource Management, Communication Management, Risk Management, Project management tools Advanced life cycle models, Testing and maintenance and software project documentation, IT Management.				

SE4105	Human Computer Interaction Design	TH	-	-
HCI Principles, Usability principles, Building a simple GUI, Human abilities, Human-centered software development, Cultural aspects, Human-centered software evaluation, GUI design, GUI programming, HCI aspects of multimedia systems, HCI aspects of collaboration & communication, Validation of usability & user experience, Handling errors & help.				

SE4106	Projects in Web Systems and Technologies	-	-	PR
This Project will provide students with the principles and practical programming skills of developing Internet and Web applications. Students have to develop a Web application using web development languages Such as HTML, CSS, JavaScript and PHP. This is an individual project.				

SE4107	Industrial Inspection	-	IFV	PR
Students are provided with industry exposure through industrial visits.				

SE4108	Risk Management	TH	-	-
Background of Risk Management, Management Processes: Risk Identification, developing a Risk Management Plan, Analyse & Prioritize Risks: Qualitative Risk Analysis, Quantitative Risk Analysis, Develop Risk Responses, Risk Monitoring & Control, Assessment Frameworks (OCTAVE, FAIR, NIST SP800-30, and ISO 27005), Application of Risk Assessment Frameworks, Authentication & Authorization, Intrusion Detection.				

SE4109	Communication Skills	TH	-	-
Reading, understanding, and summarizing reading (e.g., source code, and documentation), Writing (assignments, reports, evaluations, justifications, etc.), Team and group communication (both oral and written, email, etc.), Presentation skills.				

SE4110	Management Information Systems	TH	-	-
Management within the organization: Management activities, Roles and Levels; Management Planning, Controlling and Strategic planning, Decision making and using MIS: Measurement of MIS performance and capabilities, MIS applications and relationships: Introduction to different types of Computing and Information Systems, Databases and data warehouses and their relevance to MIS; Networks, Internet and MIS, Development of MIS: Managing MIS Project, Techniques and methodologies for supporting MIS development, Customer Relationship Management (CRM) and Supply Chain Management (SCM), Financial Systems and E-Commerce, Business Process Redesigning using new trends in MIS (ERP, Mobile and Cloud enabled MIS etc.).				

SE-EAP-2201	Academic English II	TH	-	-
Refer English Curriculum (Page 88 & 89)				

Semester V				
SE5101	Computer and Network Security	TH	PRS	-
Basic Security Concepts: Confidentiality, integrity, availability, Security policies, security mechanisms, assurance, Basic Cryptography: Historical background, Transposition/Substitution, Caesar Cipher, Introduction to Symmetric crypto primitives, Asymmetric crypto primitives, and Hash functions, Secret Key Cryptography, Data Encryption Standard (DES), Encrypting large messages (ECB, CBC, OFB, CFB, CTR), Multiple Encryption DES (EDE), Message Digests: Applications, Strong and weak collision resistance, The Birthday Paradox, MD5, SHA-1 T5, Public Key Cryptography, Number theory: Euclidean algorithm, Euler Theorem, Fermat Theorem, Totent functions, multiplicative and additive inverse, RSA, Selection of public and private keys, Authentication: Basic concepts of identification and authentication, Password authentication, Authentication protocols, Trusted Intermediaries: Public Key infrastructures, Certification authorities and key distribution centers, Kerberos, Real-time Communication Security: IPsec: AH and ESP, IPsec: IKE, Hans on experience in Computer and Network Security.			

SE5102	Software Testing	TH	PRS	-
Unit testing and test-driven development, Exception handling (testing edge cases and boundary conditions), Coverage analysis and structure-based testing, Black-box functional testing techniques, Integration testing, Developing test cases based on use cases and/or user stories, Testing based on operational profiles (e.g., most-used operations first), System and acceptance testing, Testing across quality attributes (e.g., usability, security, compatibility, and accessibility), Regression testing, Testing tools and automation, User interface testing, Usability testing and Performance testing, Use of Software Testing tools and techniques				

SE5103	Product Assurance	TH	-	-
The nature of product assurance, Distinctions between assurance and V&V, Quality product models, Root cause analysis and defect prevention, Quality product metrics and measurement, Assessment of product quality attributes (e.g., usability, reliability and availability).				

SE5104	Mini Project	-	-	PR
Study the basic concepts of programming concepts & application to design & implement the mini project intended solution for project-based learning.				

SE5105	Evolution processes and activities	TH	-	-
Introduction to process evolution, importance of evolution, Programme evolution dynamics, Working with legacy systems, Basics of refactoring, Traditional life cycle models, Software product life cycle models, Software production setting models, Evaluating life cycle models and methodologies, Customize life cycle process models				

SE5106	IT Auditing	TH	-	-
IT Audit Overview: Roles of the IS auditor and IS audit functions, Auditing and Internal Control, Auditing IT Governance Controls, Auditing Operating Systems and Networks, Auditing Database Systems, Computer-Assisted Audit Tools and Techniques, Business Ethics, Fraud and Fraud Detection, IT auditing frameworks.				

SE5107	Human Resource Management	TH	-	-
Uniqueness of Human Resource, Human Resource Management, Purpose of HRM, Importance & Responsibility for functions of HRM, Jobs, job designing & Job analysis. The necessity for Job re-designing, Job redesigning methods, Alternative work schedules. Value of Job Analysis, Job Description & Job Specification, HR Planning, HR Planning Process Recruitment & process of recruitment, Employer branding, New trends in recruitment – Active Sourcing/SNS recruitment. Significance of employee selections Selection methods & selection process, Errors in employee selection Process of hiring, Probationary period, Employee orientation. Definition of Employee Performance Evaluation (EPE), Significance of EPE, EPE methods, Developing PE system. Definition–Learning, Education, training, development, Learning Principles, Training needs analysis. Training programme designing, Effective implementation of training Programmes, Evaluation of training programmes. Reward & total reward, Basic Salary determination - Job evaluation, Pay survey, Performance based pay, Employee benefits, and Legal provisions for reward management in Sri Lanka. Grievance Handling (GH), Importance of GH, Methods of GH, Practical tips in HG. Discipline management, Hot Stove Model, Misconducts, Domestic Inquiry. The concepts of occupational health & safety, Hazards & factors affecting health & safety, Interventions for improving health & safety. Human Resource Information Systems. Green HRM, HR Analytics, HR Scorecards				

SE5108	Geographic Information Systems	TH	-	-
Introduction to GIS - What is Geographic Information Systems, Different components of GIS, Different types of vector data, Raster data models & their types, TIN data model; Data Representations - Advantages & disadvantages associated with vector, raster & TIN, Non-spatial data (attributes) & their type, Raster data compression techniques, Different raster data file formats, Spatial database systems & their types; Map Projections - Pre-processing of spatial datasets, Different map projections, Spatial interpolation techniques, Different types of resolutions, Digital Elevation Model (DEM). Geographic Phenomena. Hands on experience with GIS, Hands on experience with different spatial related APIs (Geo Coding API, LocationIQ API, Google Maps API etc.).				

SE5109	Logistic System and Transportation Management	TH	-	-
Evolution of Logistics, Integrated logistics, Evolution of Supply Chain Management, Supply Chain Overview, Global Supply Chains, Supply Chain Strategy, Supply Chain Planning, Supply Chain Performance Management, Supply Chain Financial Control, Demand and Order Management, Supply Chain Operations Reference model. Networking and Transportation, Shipment Management, Fleet/Container Management, Carrier Management, Freight Management, Reverse Logistics, Outsourcing - Third Party Logistics (3PL)				

Provider/Lead Logistics Provider (LLP), Import and Export Procedures, Freight forwarding agencies and shipment services. National and international law, Legislation, Regulations, Safety requirements, and Professional standards.

SE5110	Business Intelligence	TH	-	-
Decision Support Systems and Business Intelligence: Business Environment Factors (markets, consumer demands, technology, and societal, etc.), Decision Support Frameworks (Degree of Structuredness vs. Types of Control), Automated Decision Making, Evolution of BI Capabilities, DSS & BI Architectures, Styles and Benefits of BI, Elements of a Work Systems, Major Tool Categories for Management Support Systems. Decision Making, Systems, Modeling, and Support: Introduction to Decision-Making Disciplines, Characteristics of Decision Making and Decision Styles, Types and Benefits of Decision-Making Models, Decision-Making Process, New Technologies to Support Decision Making, Key Data Issues and Key Ingredients of Data (Information) Quality Management, Decision Support Systems Concepts, Methodologies, and Technologies: DSS Characteristics and Capabilities, DSS Classifications, Major DSS Components and Web Impacts, Future/current DSS Developments Emerging Trends and Impacts: RFID and BI (RFID for BI in Supply Chain, RFID + Sensors for Better BI, etc.), Reality Mining and Virtual Worlds in BI applications, Web X.0 Revolutions, Virtual (Internet) Communities and Types, Online Social Networking and Social Network Analysis, Implications of Business and Enterprise Social Networks, Cloud Computing and BI, Issues of Legality, Privacy and Ethics. Collaborative Computer-Supported Technologies and Group Support Systems: Why (business) collaboration is difficult?, Time/Place Communication Framework, Groupware for (business) collaboration, Group Support Systems and Important Features, GSS Enabling Technologies, Collaborative Planning, Forecasting, and Replenishment (CPFR) and Collective Intelligence, Introduction to Taxonomy of Collective Intelligence.				

SE-EBP-3101	Business English	TH	-	-
Refer English Curriculum (Page 88 & 89)				

Semester VI				
SE6101	Community Project	-	-	PR
Independent Topics related to Software development will be conducted.				

SE6102	Cloud Computing	TH	PRS	-
Cloud Computing Concepts: Introduction to cloud computing, Properties, characteristics & disadvantages, Gossip, Membership & Grids, P2P Systems, Key-Value Stores, Time & Ordering Classical Distributed Algorithms. Cloud Systems & Infrastructure: Cloud computing stack, Service model, Deployment models, Containers, virtual machines, MAAS, PAAS, Web Services. Storage: Ceph, SWIFT, HDFS, NAAS, SAN, Zookeeper. Big Data & Applications in the Cloud: Spark, Hortonworks, HDFS, CAP, Streaming Systems, Graph Processing & Machine Learning, Cloud Resource management & Service management in cloud computing. Cloud Networking: Introduction to cloud networking SDN with cloud, Data center networking. Cloud security: Identity & Access management, Access control, Authentication in cloud computing, Developing application in cloud				

platform, Introduction to Cloud Computing with AWS, Azure google's cloud platform. Research trends in cloud: Edge & Fog computing, cloud & IoT. Hands-on experience using a cloud-based tool.

SE6103	Parallel and Distributed Systems	TH	PRS	-
Introduction to Parallel & Distributed Programming (definitions, taxonomies, trends), Parallel Computing Architectures, Paradigms, Issues, & Technologies (architectures, topologies, organizations), Parallel Programming (performance, programming paradigms, applications), Parallel Programming Using Shared Memory I (basics of shared memory programming, memory coherence, race conditions & deadlock detection, synchronization), Parallel Programming Using Shared Memory II (multithreaded programming, OpenMP, pthreads, Java threads), Parallel Programming using Message Passing - I (basics of message passing techniques, synchronous/asynchronous messaging, partitioning & loadbalancing), Parallel Programming using Message Passing - II (MPI), Advanced,(accelerators, CUDA, OpenCL, PGAS), Introduction to Distributed Programming (architectures, programming models), Distributed Programming Issues/Algorithms (fundamental issues & concepts - synchronization, mutual exclusion, termination detection, clocks, event ordering, locking), Distributed Computing Tools & Technologies I (CORBA, JavaRMI), Distributed Computing Tools & Technologies II (Web Services, shared spaces), Distributed Computing Tools & Technologies III (Map-Reduce, Hadoop), Parallel & Distributed Computing – Trends & Visions (Cloud & Grid Computing, P2P Computing, Autonomic Computing), Cloud based tool will be used to conduct the practical.			

SE6104	Advanced Database Management Systems	TH	PRS	-
Database Design & Implementation - Relational Database Design, Database Implementation & Tools, Advanced SQL, Database System Catalog, DBMS Advance Features - Query Processing & Evaluation, Transaction Management & Recovery, Database Security & Authorization, Distributed Databases - Enhanced Database Models, Object Oriented Databases, Database & XML. Emerging Trends & Example of DBMS Architecture - Emerging Database Models, Technologies & Applications, Big data, Advanced SQL - Temporary table, Views, Stored procedures, Stored function &Triggers				

SE6105	Software Architecture	TH	-	-
Basic concepts & principles about software architecture, Introduction to Software Architectural pattern, ADL, 4+1 Architecture, Practical approaches & methods for Create & Analyse software architecture, Quality attributes of software architectures, Examples in architectural design applications & case studies in software architecture (N tier architecture, SOA, Cloud, etc.)				

SE6106	Software Design Patterns	TH	PRS	-
Introduction to Design Patterns: A Brief History, How Design Patterns Solve Design Problems, How to Select & Use a Design Pattern, The Catalog of GoF (Gang-of-Four) Design Patterns, Creational Patterns: Abstract Factory, Factory Method, Singleton, Structural Patterns: Adapter, Composite, Decorator, Behavioral Patterns: Observer, Strategy, Template Method Pattern, Model-View-Controller				

(MVC) Pattern, Design Principles for creating software that is flexible, reusable, and maintainable, Symptoms of bad design (anti-patterns), Hands on experience in modelling using a UML professional design software and OOP programming.

SE6107	Software Design Evaluation	TH	-	-
Introduction to design evaluation, Importance of design evaluation, Software architecture design: evaluation and transformation, Design attributes (e.g., coupling, cohesion, information hiding and separation of concerns), Design metrics, Life-cycle architecture milestone, Complex system of systems (SoS) environment, Functionality-based architecture design, Formal design analysis, Assessing non-functional requirements design, Architecture patterns quality estimation, Selection of an optimal patterns suite.				

SE6108	Current Topics in Software Engineering	TH	WS	-
Current Topics in Software Engineering, Professional issues, Emerging trends, Current topics in Software Engineering research.				

SE6109	Enterprise Modeling Ontologies	TH	PRS	-
Introduction to the Semantic Web, Introduction to Ontologies, Ontology Languages for the Semantic Web, Resource Description Framework (RDF), Lightweight ontologies: RDF Schema, Web Ontology Language (OWL), A query language for RDF: SPARQL, Ontology Engineering, Semantic web & Web 2.0, Applications of Semantic Web, Hands-on experience with Protégé tool.				

SE6110	Software Engineering Economics	TH	-	-
Economic Aspect of Information & Information Systems, Problem of Asymmetric Information: Adverse Selection & Moral Hazard, Macroeconomic & Microeconomic Aspects of Information Systems, Basic Economic Principles on Firms, Markets, Industries & Organization; Demand & Supply Analysis, Economic Impacts of Telecommunication & Digital Media, Sustainable Development & Information Technology, Intellectual Property Rights & Knowledge Based Economy, The Impact of Information Systems on Employment /Unemployment, Pricing & Marketing of Information Goods.				

SE6111	Social Computing	TH	WS	-
Social networking, Enterprise 2.0, Internet activism/advocacy, Crowdsourcing, e-Government/ Government 2.0, Social/viral marketing, Social information processing, Social network analysis and the use of blogging, podcasts, wikis and other collaboration tools.				

SE6112	Semantic Web	TH	PRS	-
Introduction to Knowledge Representation and the Semantic Web, Description logics and classifiers, Methods for developing and evaluating ontologies: Theoretical aspects: definition, scope, types of ontologies, ontology repositories, Common problems in ontology development, Architectures and languages used in creating semantic web services [RDF(S) and OWL], Hands on experience in semantic web development.				

SE6113	Robotics	TH	PRS	PR
Introduction to Robotics: The Engineering Design Process, Best practices in engineering design, Introduction to Computer Programming: Fundamentals of computer languages and machine logic, The "Hello World!" Programme, Variables, arithmetic operations and logical operations, Conditional statements, Loops and Iterations, Functions and calls, Libraries, Introduction to Electric Circuits: Electricity, voltage and current, Fundamentals of electric circuits, Ideal sources and resistors, Ohm's law and Kirchhof's law, Capacitors and RC circuits, Early Robotic Topics, Sensors, Actuators and Manipulators: Micro controllers, Sensors and actuators, Manipulators, Gears and other mechanical systems, Introduction to Robot Mechanics: Power and torque Acceleration and velocity, Design models for ground mobile robots, Design models for mechanic arms and lifting systems, Fundamentals of kinematics, Advanced Topics on Robotics: Sensing distance and direction, Line Following Algorithms, Feedback Systems, Other topics on advance robotic techniques, Hands on experience in robotic technologies.				

Semester VII				
SE7101	Industrial Training	-	-	PR
Students will be required to complete industrial training related to Information Systems at a relevant industry or research institution. The duration of the project period should be a minimum of 15 weeks. A project report (thesis if it is a research) should be submitted at the end of the semester & should be presented & defended by the respective student in front of an evaluation panel appointed by the department.				

Semester VIII				
SE8101	Research Project	-	WS	THS
The course starts with a reflection and discussion about interdisciplinary research, where students define their research topics. Throughout the course, the students work in developing their research questions and choose the appropriate methodological approaches for their research and analyze the results. Students should be able to provide valid findings in selected research domains and report in a format of thesis and submit it to the department. They are encouraged to present their findings in local and international research forums.				

SE8102	Research Methods	TH	-	-
Introduction to the notion of research, Literature review, Research designs, Identifying data requirements, sources, & instruments for data gathering, Undertaking 'experiments', Validation: Types of validation, Analysing research data, Writing Strategies, Ethical Consideration.				

SE8103	Service Oriented Architecture	TH	-	-
Introduction to XML: XML document structure; Well-formed and valid documents; Namespaces; DTD; XML Schema, Building XML-based Applications: Parsing XM; using DOM, SAX; XML Transformation and XSL; XSL Formatting, Modeling Databases in XML Service Oriented Architecture: Characteristics of SOA, Comparing SOA with Client-Server and Distributed architecture; Benefits of SOA;				

Principles of Service orientation; Service layers, Web Services: Service descriptions; WSDL; Messaging with SOAP; Service discovery; UDDI; Message Exchange Patterns; Orchestration; Choreography; WS Transactions, Building SOA-based Applications: Service Oriented Analysis and Design; Service Modeling; Design standards and guidelines; Composition; WS-BPEL; WS-Coordination; WS-Policy; WS-Security.

SE8104	Problem Analysis and Reporting	TH	-	-
Introduction to potential failures and defects, Analyzing the existing failure reports, Method to report failures and defects, Types of reports structuring failure reports, Scientific methods and techniques for debugging and fault isolation, Reading and understanding the code base, Defect analysis, Root cause analysis and problem tracking.				

SE8105	Machine Learning	TH	PRS	-
Introduction to machine learning & neural networks: supervised learning, linear models for regression, basic neural network structure, Deep learning. Neural networks: Forward Propagation, Cost Functions, Error Backpropagation, training by gradient descent, bias/variance & under/ overfitting, regularization, Exercises on NNs, solving a problem with NNs on TensorFlow. Exercises on CNN, solving a problem with CNN on TensorFlow. Exercises on RNNs, solving a problem with RNNs on TensorFlow.				

SE8106	Mobile Computing	TH	PRS	-
Native & Cross-platform Development, Mobile Application Development Languages & Frameworks, Development Tools & Version controlling, Mobile Application Architectures and Design Patterns, Graphics & User Interface Design, Data Persistence, APIs & Libraries, Files & Media, Camera & Motions sensors, GPS/ location sensing & Maps, Network programming, Future Trends (Augmented Reality, M-Commerce, Low Code Development), Security, & Marketplace deployment, Hands on experience in Mobile application development.				

SE8107	Refactoring	TH	-	-
Introduction to principles in refactoring, bad smells in code, building tests, toward a catalog of refactoring, Composing methods, Moving features between objects, Organizing data, Simplifying conditional expressions, Making method calls simpler, Dealing with generalization, Big refactoring, reuse and reality, Refactoring tools.				

SE8108	Game Designing and Development	TH	PRS	WS
A Brief History of Video Games, Games and Society, Game Design (with 3D Characters: Animation & control), Teams and Processes in Games, Programming Fundamentals for Game Development, Debugging Games, Game Architecture, Memory and I/O Systems in Game Development Environments, Mathematical Concepts for Games, Collision Detection and Resolution, Graphics for Games, Artificial Intelligence in Games, Networks and Multiplayer Mode for Game, UI				

Development, Connecting games to services Databases, Global illumination, code library, This module laboratory session is covered by using a suitable gaming library and develop simple gaming applications on given scenario.

SE8109	Data Mining	TH	PRS	-
Clustering Algorithms: K-mean, Agglomerative algorithm, Classification Algorithms: Decision Tree, Support Vector Machine, Association rule mining, and Topic extraction, Implementation of datamining algorithms using python and Weka tools.				

SE8110	Big Data Analytics	TH	PRS	-
Introduction to Big Data, Handling and Processing Big Data, Methodological Challenges and Problems, Deep Analytics and Visualization and Example Applications, Hand on experience in big data analysis tools and techniques.				

SE8111	Artificial Intelligence	TH	PRS	-
Foundation of AI, Nature of Knowledge and Intelligent machine, Influential areas for AI, Turing Test and John Searle's argument, State of the art Search and Problem solving, Knowledge Representation and Major Areas of AI, Hand on experience in AI tools and techniques.				

Rules and Regulations

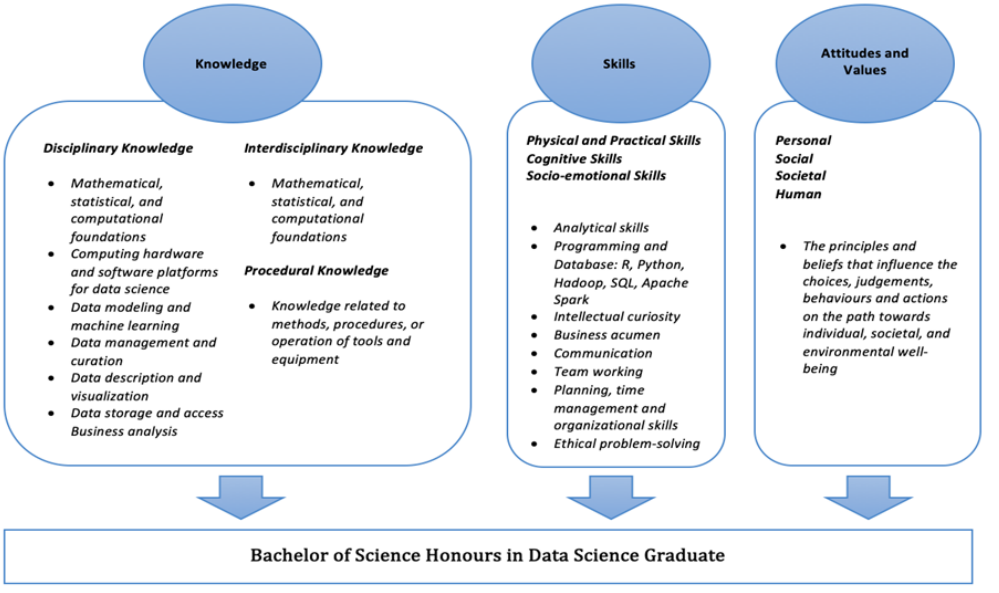
1. Students should complete (obtain at least D+ grade) for the credited, compulsory and non-GPA courses Communication Skills I, Communication Skills II, General English I, General English II, Academic English I, Academic English II and Business English to be eligible for the award of the BScHons (SE) degree.
2. Student should follow at least courses which are not less than total credits of four (04) out of ten (10) credits elective course in the Semester V and VI.
3. Student should go for the Industry Placement in the Semester VII, which is compulsory for all. Also, students should submit Internship Placement Offer Letter to the Department prior to the commencement of Semester VII.
4. Student should follow at least courses which are not less than total credits of four (04) out of eight (08) credits elective course in the Semester VIII.
5. Mini Project (SE 5104) is an intended solution for project-based learning for any industrial, academic, educational, or institutional community inside Sri Lanka.
6. Community Project (SE 6101) is a software development project for any industrial, academic, educational, or institutional community inside Sri Lanka.
7. For Industrial Inspection (SE 4107), compulsory one credited and Three (03) industrial organizations/venues will be organized during the semester IV. A report should be submitted for each industrial inspection.
8. Depending on the availability of the resources, elective courses will be conducted in the Semester V, VI and VIII.
9. Students should submit the Research Proposal for the BSc Research Project during the first part of the semester VII and the Research will commence thereafter and there will be regular progress presentations from beginning of the Semester VIII to the end of the semester VIII. This is completely a research project and not an internship in the industry

DEPARTMENT OF DATA SCIENCE

Degree Programme

Bachelor of Science Honours in Data Science [BScHons (DS)]

Graduate Profile



Guidelines for course codes and credits

- Each course code consists of four digits together with the prefix (alphabet letters)
- Prefix alphabet letters denote the abbreviation to the name of degree Programme (DS)
- The first digit of each course code is the corresponding semester of study (1-8).
- Second digit represents the revision of the subject, and it will increment if the subject is revised.
- Third and fourth digits represent the subject code

Example: The course code of DS1101 denotes the following;

Abbreviated name of degree Programme	Semester	Revision Number	Subject Code
DS (Data Science)	1	1	01

Note: There are no spaces or special characters in the course code.

Summary of the Courses

Table 1: Courses offered in the Semester I			
Course Code	Course Title	No of Credits	Compulsory or Elective
DS1101	Introduction to Data Science	1	Compulsory
DS1102	Programming Fundamentals	2	Compulsory
DS1103	Calculus	2	Compulsory
DS1104	Introduction to Statistics	2	Compulsory
DS1105	Database Management Systems	2	Compulsory
DS1106	Computer System Organization	2	Compulsory
DS1107	Data and Society	1	Compulsory
DS1108	Web Programming I	2	Compulsory
DS1109	Communication Skills I	-	Compulsory (Non-GPA)
DS1110	Academic Integrity	-	Compulsory (Non-GPA)
DS-EGP-1101	General English I	-	Compulsory (Non-GPA)
	Total	14	

Table 2: Courses offered in the Semester II			
Course Code	Course Title	No of Credits	Compulsory or Elective
DS2101	Operating Systems	2	Compulsory
DS2102	Data Structures	2	Compulsory
DS2103	Linear Algebra	2	Compulsory
DS2104	Object Oriented Programming	2	Compulsory
DS2105	Capstone Project in Data Science I	2	Compulsory
DS2106	Analysis of Algorithms	2	Compulsory
DS2107	System Analysis and Design	2	Compulsory
DS2108	Data Pre-Processing	1	Compulsory
DS2109	Communication Skills II	-	Compulsory (Non-GPA)
DS-EGP-1201	General English II	-	Compulsory (Non-GPA)
	Total	15	

Table 3: Courses offered in the Semester III			
Course Code	Course Title	No of Credits	Compulsory or Elective
DS3101	Probability Theory	2	Compulsory
DS3102	Regression Analysis	2	Compulsory
DS3103	Multivariate Calculus	2	Compulsory
DS3104	Real World Analytics	1	Compulsory
DS3105	Computer Networking	2	Compulsory
DS3106	Data Warehousing	2	Compulsory

DS3107	Web Programming II	2	Compulsory
DS-EAP-2101	Academic English I	-	Compulsory (Non-GPA)
	Total	13	

Table 4: Courses offered in the Semester IV			
Course Code	Course Title	No of Credits	Compulsory or Elective
DS4101	Advanced Database Management Systems	2	Compulsory
DS4102	Scientific Writing & Documentation	1	Compulsory
DS4103	Software Engineering	2	Compulsory
DS4104	Data Visualization	2	Compulsory
DS4105	Capstone Project in Data Science II	2	Compulsory
DS4106	Applied Data Mining	2	Compulsory
DS4107	Social and Professional Issues in Computing	2	Compulsory
DS4108	Business Intelligence	2	Compulsory
DS4109	Discrete Mathematics	2	Compulsory
DS4110	Artificial Intelligence	2	Compulsory
DS-EAP-2201	Academic English II	-	Compulsory (Non-GPA)
	Total	19	

Table 5: Courses offered in the Semester V			
Course Code	Course Title	No of Credits	Compulsory or Elective
DS5101	Semantic Web	2	Compulsory
DS5102	Time Series Analysis and Forecasting	2	Compulsory
DS5103	Information Security	2	Compulsory
DS5104	Machine Learning	2	Compulsory
DS5105	Linear Programming	2	Compulsory
DS5106	Graph Theory	2	Compulsory
DS-EBP-3101	Business English	-	Compulsory (Non-GPA)
Students should select courses covering 04 Credits from the following elective courses			
DS5107	Image Processing	2	Elective
DS5108	Mobile Computing	2	Elective
DS5109	Data Science for Bioinformatics	2	Elective
DS5110	Human Resource Management	2	Elective
DS5111	Parallel and Distributed Computing	2	Elective
	Total (Compulsory + Electives)	16	
Table 6: Courses offered in the Semester VI			
Course Code	Course Title	No of	Compulsory

		Credits	or Elective
DS6101	Introduction to Deep Learning	1	Compulsory
DS6102	Bayesian Learning and Graphical Models	2	Compulsory
DS6103	Mathematical Optimization	2	Compulsory
DS6104	Industrial Training	6	Compulsory
Students should select courses covering 02 Credits from the following elective courses			
DS6105	Web Services	2	Elective
DS6106	Cloud Computing	2	Elective
DS6107	Business Process Management	2	Elective
DS6108	Software Quality Assurance	2	Elective
DS6109	Fraud and Anomaly Detection	2	Elective
	Total (Compulsory + Electives)	13	

Table 7: Courses offered in the Semester VII			
Course Code	Course Title	No of Credits	Compulsory or Elective
DS7101	Research Method	2	Compulsory
DS7102	Advanced Deep Learning	2	Compulsory
DS7103	Emerging Trends in Data Science	1	Compulsory
DS7104	Numerical Methods	2	Compulsory
DS7105	Natural Language Processing	2	Compulsory
Students should select courses covering 04 Credits from the following elective courses			
DS7106	Entrepreneurship and Innovation	2	Elective
DS7107	Internet of Things	2	Elective
DS7108	Design Patterns and Anti-patterns	2	Elective
DS7109	Ontology Engineering	2	Elective
DS7110	Blockchain and Cryptocurrency	2	Elective
	Total (Compulsory + Electives)	13	

Table 8: Courses offered in the Semester VIII			
Course Code	Course Title	No of Credits	Compulsory or Elective
DS8101	Research Project in Data Science	8	Compulsory
DS8102	Information Retrieval and Web Analytics	2	Compulsory
DS8103	Reinforcement Learning	2	Compulsory
DS8104	Computational Intelligence	2	Compulsory
DS8105	Business Analytics and Applications	1	Compulsory
Students should select courses covering 02 Credits from the following elective courses			
DS8106	Geographical Information Systems	2	Elective
DS8107	Digital Forensics	2	Elective
DS8108	Business Process Simulation	2	Elective
DS8109	Robotics	2	Elective
	Total (Compulsory + Electives)	17	

Summary of Credits Required

	Semester I	Semester II	Semester III	Semester IV	Semester V	Semester VI	Semester VII	Semester VIII
Credited and Compulsory courses	14	15	13	19	12	11	09	15
Credited and Elective courses	-	-	-	-	04	02	04	02
Credited, Compulsory and Non-GPA Courses	06	04	02	02	02	-	-	-
Total credits	29		32		29		30	
Total credits for the degree programme	120							

Detailed Syllabus

N.B.

TH - Theory
PRS - Practical
IFV - The department organizes the field visit relevant to the particular subject area.
WS - The department organizes workshops relevant to a particular course unit.
THS- Thesis
PR - Report on a research and /or development work

Semester I				
DS1101	Introduction to Data Science	TH	-	-
Overview of Data Science. Data Collection, Integration, Management, Modeling, Analysis, Visualization, Prediction, Abnormalities in data. Informed decision making. Data science project lifecycle. Data products for business applications. Introduction to data security and data privacy.				

DS1102	Programming Fundamentals	TH	PRS	-
Introduction: Relationship between computers and Programmes, Basic principles of computers, File systems, Using the Python interpreter, Introduction to binary computation -- Input / Output. Data types and control structures: Operators (unary, arithmetic, etc.), Data types, variables, expressions, and statements, Assignment statements, Strings and string operations. Control Structures: loops and decision. Modularization and Classes: Standard modules, Packages, Defining Classes, Defining functions, Functions and arguments (signature). Data structures: Data Structures (array, List, Dictionary, Tuples, and Sets). Exceptions: Testing, Error processing: Exception Raising and Handling.				

DS1103	Calculus	TH	-	-
The real number system: Real number system as a complete ordered field, Complex number system, Neighbourhoods. Sequences and limits: Definition of convergence, Limit theorems, Monotonic sequences, Monotone convergence theorem, Algebra of limits. Limits and continuity of real valued functions: Limit of a function, Algebra of limits, Continuity of a function, Properties of continuous functions, Sequential criterion for limits and continuity, Intermediate value theorem and extreme value theorem. Differentiability of real valued functions: The definition of the derivative, Algebra of derivatives, Product and quotient rules, Rolle's theorem, Mean-value theorem and its applications, L'Hospital's rule. Applications of the derivative: Optimization problems, Related rates problems, Graph sketching.				

DS1104	Introduction to Statistics	TH	-	-
Exploring data using charts: bar chart, pie chart, multiple bar chart, stack bar chart, histogram, scatter plot. One-way, Two-way cross classification tables, Central tendency measures, dispersion measures: range, IQR, variance, and standard deviation. Box plot and its application, Correlation: Pearson correlation and Spearman rank correlation and their application, Report writing based on the exploratory data analysis outcomes.				

DS1105	Database Management Systems	TH	-	-
Introduction to Databases: Definition of the database, database system, data models, database applications. Database system architecture, Characteristics of database approaches. Database development process. Data models. Relational model. ER model. Schema Mapping. Designing: Logical design: Relational database model, Logical view of data, keys, Integrity rules, Normalization. Relational algebra: Introduction, Selection & projection, Set operations, Renaming, Joins, Division, Syntax, Semantics, Operators, Grouping & ungrouping, Relational, Triggers.				

DS1106	Computer System Organization	TH	-	-
Basic concept and computer evolution: Organization and Architecture, The evolution of the Intel x86 Architecture, Embedded Systems, ARM architecture. Computer Performance Issues: Multicore, MIC and GPGPUs, Basic Measures of Computer Performance, Benchmark and SPEC. Computer Function and interconnection: Computer Bus Interconnection, Point to Point Interconnection. Computer Memory System: Cache Memory Principles, Semiconductor main memory, External memory. Input/output: External Devices, I/O Modules, Interrupt Driven I/O, Programmed I/O, I/O channels and processors, External Interconnection Standards. Arithmetic and Logic: number system, Integer Representation, Floating Point representation, Digital logic, Combinational Circuits, Sequential Circuits, Programmable Logic Devices. The Central Processing Unit: Machine Instruction Characteristics, Addressing Modes, Assembly language, Processor, Instruction Level Parallelism and Superscalar Processor. Parallel Organization: Parallel processing, Multicore computers, General purpose graphic processing unit.				

DS1107	Data and Society	TH	-	-
Introduction to the course: Platforms, Data and the Digital Economy. The Digitization of Everyday Life: Sensors, Signals and Devices Seminar: Data politics and the politics of data. Digital Platforms. Platform Ecosystems. Social Media: Privacy and Information Passing. Sociological Inquiry and Big Data.				

DS1108	Web Programming I	TH	PRS	-
Internet fundamentals. HTML. Cascading Style Sheets (CSS). Client-side Scripting: JavaScript, Typescript and pug, AJAX. Introduction to UI Frameworks with responsive front-end design. Introduction to Browser based developer tools. Practical: Hands on experience in web tools.				

DS1109	Communication Skills I	TH	-	-
Introduction to Communication: Purpose of Communication; Process of Communication; Importance of Communication in Business; Differences between Technical and General Communication; Barriers to Communication; Measures to Overcome the Barriers to Communication, Types of Communication: Types of Communication; Verbal Communication-Importance of verbal communication-Advantages of verbal communication- Advantages of written communication; Significance of Non-verbal Communication, Listening Skills: Listening Process;				

Classification of Listening; Purpose of Listening; Common Barriers to the Listening Process; Measures to Improve Listening; Listening as an Important Skill in Workplace, Language for Communication: Language and Communication; General Principles of Writing; Improving Writing Skills; Essentials of good style; Expressions and words to be avoided; Grammar and Usage, Communication in Organizations: Internal Communication; Stakeholders in Internal Communication; Channels of Internal Communication; External Communication; Stakeholders in External Communication; Channels of External Communication, Communication Network: Scope and Types of Communication Network; Formal and Informal Communication Network; Upward Communication; Downward Communication; Horizontal Communication; Diagonal Communication, Writing Business Letter: Importance of Business Letters; Difference between Personal and Business Letters; Structure and Format of Business Letters; Types of Business Letters.

DS1110	Academic Integrity	TH	-	-
Introduction to academic integrity, Academic integrity policies, Plagiarism, collusion and contract cheating, putting academic integrity into practice, Research ethics, Citing and referencing, Reading and Note-making, Critical Thinking				

DS-EGP-1101	General English I	TH	-	-
Refer English Curriculum (Page 88 & 89)				

Semester II				
DS2101	Operating Systems	TH	PRS	-
Operating Systems Overview (Historical development, Operating system objectives and functionalities, Major achievements). Process & Thread Management (Process concepts, Thread concepts, Descriptions, structures, and controls, Multiprocessors and Multi Thread programming). CPU Scheduling. Concurrency Control (Mutual exclusion, Synchronization, Deadlock, Starvation). Memory Management (Multiprogramming and partitions, Paging and segmentation, Virtual memory, Demand paging, Page replacement algorithms). I/O & File Management (I/O devices, Disk scheduling, File organization, Directory structures). Case Studies.				

DS2102	Data Structures	TH	-	-
Introduction to Data structures: Abstract Data Types and applications, Time and space requirements of algorithms. Arrays: Representation and implementation, Polynomials, Sparse matrices, String-pattern Matching. Stack and Queues: Representation and implementation, multiple stacks and queues, recursion in stacks. Linked Lists, Representation and implementation, Doubly linked list, Circular linked list. Trees: Binary tree representation, traversals and applications, Threaded binary trees, Binary Search Trees, AVL Trees. Graphs: Graph representations, Graph Traversals: Depth-first search, Breadth-first search, Weighted Graphs. Priority Queues: Heap Structures, Binomial Heaps, Leftist Heaps.				

DS2103	Linear Algebra	TH	-	-
Vector Spaces: Vector spaces and Subspaces, Linear Independence, Basis, and Dimension, Linear transformations, applications. Solving Systems of linear equations: Elementary row operations, Elementary matrices; Matrix algebra, the				

inverse of a matrix, The LU factorization, applications. Determinants: Determinants of a matrix, properties of determinants, Cramer's rule, Eigenvalues and Eigenvectors, Similarity and Diagonalization, applications. Inner Product Spaces: Inner Product, Norm of vector, Inner product spaces, The Gram-Schmidt Process, The QR Factorization Least-Squares Problems, The Singular Value Decomposition, applications.

DS2104	Object Oriented Programming	TH	PRS	-
Fundamentals of Object-Oriented Programming; Classes & Objects. Data Abstraction. Information Hiding & Encapsulation. Methods: Void methods, return methods, argument passing. Inheritance. Polymorphism: Method overloading and method overriding. Abstract Classes. Exception Handling. Files & Database connections.				

DS2105	Capstone Project in Data Science I	-	WS	PR
Capstone project may involve investigation of data engineering tools, installation, and configuration. The students will apply their knowledge on relational data model and management, NoSQL data model and management and data distribution. Moreover, the students will utilize their knowledge on data distribution, data processing techniques such as cleaning, transforming, and enriching data. In addition, students will acquire the skills in using Big data platforms.				

DS2106	Analysis of Algorithms	TH	-	-
Introduction to algorithms. Basic algorithmic analysis. Simple Searching Algorithms. Simple Sorting Algorithms. Recursion. Advanced Searching Algorithms. Advanced Sorting Algorithms. Graph Algorithms -Breadth first search, Depth first search. Dynamic Programming. Greedy algorithms.				

DS2107	System Analysis and Design	TH	-	-
System Analysis Fundamentals: Fundamentals System Analysis and Design (SA&D) concepts, Roles of system analyst, System development life cycle, depicting system graphically, determining feasibility, activity planning and control. Evolution of software development models. Information requirements analysis. Process requirements analysis. The essentials of design. Deployment and maintenance.				

DS2108	Data Pre-Processing	TH	PRS	-
Introduction to Data Preprocessing: What is data preprocessing?, What is dirty data?, Structuring Data, Overview of Data Cleansing. Data Quality: Data Quality, Data Quality Challenges, Raw Files and File Formats, Structured Data, Finding Data Sets, Loading Data into programming language. Summarizing Data with Statistics: Review of Basic Statistics, Summarizing Data. Data Visualization: Introduction to Data Visualization, EDA and CDA, Creating a Histogram, Box Plots, Bar Graphs, Other Graphs.				

DS2109	Communication Skills II	TH	-	-
Writing Memos, Circulars and Notices: What is a Memo?- Principles of précis writing- Approaches to memo writing- Characteristics of a memo- Guidelines for				

writing memos- Language and writing style of a memo- Format of a Memo; Circulars Guidelines for writing a circular- Languages and writing style of a circular- Format of a circular; Notices- Purpose- Format- Important points to remember while writing a notice. Report Writing: Features of Writing a Good Report; Purpose of Report Writing; Difference between Business Report and Engineering Report-Characteristics of writing a good report-Importance of communication in report writing; Guidelines for Report Writing; Steps in Report Writing; Structure of Report; Types of Reports and Different Formats. Writing E-mail: Principles of E-mail; E-mail Etiquette; Overcoming Problems in E-mail Communication. Oral Communication Skills: Oral Business Presentation- Purpose –Audience Locale; Steps in Making a Presentation- Research and planning-Structure and style Preparation –Presentation; Delivering a Presentation. Meetings: Types of Meetings; Importance of Business Meetings; Different Types of Business Meetings; Conducting Meetings-Selecting Participants-Developing Agendas-Opening Meetings-Establishing ground rules for meetings-Time management Evaluations of meeting process-Evaluating the overall meeting-Closing meetings; Common Mistakes Made at Meetings. Reading Skills: Reading Skill; Purpose of Reading; Types of Reading; Techniques for Effective Reading. Employment Communication – Resume: Contents of Good Resume; Guidelines for Writing Resume; Different Types of Resumes; Reason for a Cover Letter to Apply for a Job-Format of Cover Letter; Different Types of Cover Letters. Employment Communication – Job Interview: Importance and Factors Involving Job Interview; Characteristics of Job Interview; Job Interview Process; Job Interview Techniques- Manners and etiquettes to be maintained during an interview; Sample Questions Commonly asked During Interview.

DS-EGP-1201	General English II	TH	-	-
Refer English Curriculum (Page 88 & 89)				

Semester III				
DS3101	Probability Theory	TH	-	-
Introduction to set theory. Introduction to probability, marginal probability, conditional probability. Random variables. Discrete and continuous probability distributions: Discrete Uniform, Bernoulli, Binomial, Poisson, Continuous Uniform, normal, exponential. Introduction to t- distribution, F-distribution and Chi-square distribution.				

DS3102	Regression Analysis	TH	-	-
Simple linear regression model. OLS and ML approaches to estimate the regression parameters. Inference about regression parameters. Model validation. Handling qualitative predictors. Lack-of-fit of the model. Model selection procedures.				

DS3103	Multivariate Calculus	TH	PRS	-
Differential calculus of functions of several variables: Limits and continuity, partial derivatives, the derivative of a multivariable function, chain rule, extrema of multivariable functions, Lagrange multipliers. Integration of functions of several variables: The Jacobian, double and triple integrals, change of variables, spherical and cylindrical coordinate systems. Special functions: Beta, gamma, Bessel,				

Legendre functions, Fourier series and its applications, integral transformations. Applications of multivariate calculus in data science: Multivariate calculus in machine learning, explanation of calculus in gradient descent.

DS3104	Real World Analytics	TH	PRS	-
Identification of data to be collected to solve a real-world problem. Data source authentication. Identifying the data types. Data validation. Organizing data, Transforming data. Linearization and Regularization. Overfitting. Bias and Variance Trade-off. Interpretability methods in the context of the framework.				

DS3105	Computer Networking	TH	PRS	-
Device to Device Communication Architectures: Algorithms & protocols designed for MANET, mesh, cellular & opportunistic networks. Students will read several classic research papers to understand the design choices & vision. Content based Network Architectures: Principles of data dissemination, aggregation & caching that are applied to sensor networks, Internet of Things & other content-based paradigms. Students will survey recent research publications on opportunistic networks & next generation content-based networking ideas. Applications: P2P, Social Networks, Cloud computing applications will be discussed for the IP network & similar applications for next generation networks. These discussions will be mainly led by students & moderated by the instructor. Simulation & Experimentation: Introduction to performance analysis of new networking ideas using the Network Simulator -v3 (ns3), Click Modular Router & the GENI testbed. Students will complete lab exercises that demonstrate various capabilities of the aforementioned tools. Practical: Hands on experience with related latest tools				

DS3106	Data warehousing	TH	-	-
Data Warehousing concepts. Comparing operational database to data warehouse. Data Warehousing system and components. Data transformation process functions. Online analytical processing (OLAP) and OLAP tools. Data Warehousing applications. Data Mining concepts and techniques.				

DS3107	Web Programming II	TH	PRS	-
Introduction to PHP, server side of scripting language. Handling form input with PHP, Introduction of OOP using PHP, User authentication. PHP Basic Constructs - Variables and data types, Expressions and perators, Conditional statements, Functions, Arrays and Objects, PHP $_GET, PHP $_POST. PHP cookies, PHP sessions. What's a database and what's an RDBMS?, Introduction to SQL. Relational Database concepts, Designing a web database. Primary keys in database tables, SQL statements: SELECT, INSERT, UPDATE and DELETE. Introduction to PHPMyAdmin. Creating a database in PHPMyAdmin. Accessing a database through PHP. Inserting data into the Database, Retrieving data from the Database, Using sub queries, Updating, adding and deleting records. Accessing MYSQL database from the web with PHP, Web database architecture, Querying the database from the web. Practical: Hands on experience in web development tools.				

DS-EAP-2101	Academic English I	TH	-	-
Refer English Curriculum (Page 88 & 89)				

Semester IV				
DS4101	Advanced Database Management Systems	TH	PRS	-
Database Design & Implementation: Relational Database Design, Database Implementation & Tools, Advanced SQL, Database System Catalog. DBMS Advance Features: Query Processing & Evaluation, Transaction Management & Recovery, Database Security & Authorization. Distributed Databases: Enhanced Database Models, Object Oriented Databases, Database & XML. Emerging Trends & Example of DBMS Architecture: Emerging Database Models, Technologies & Applications, Big data. Practical: Advanced SQL: Temporary table, Views, Stored procedures, Stored function & Triggers.				

DS4102	Scientific Writing and Documentation	TH	-	-
The nature of scientific writing; the scientific paper as argument. Writing proposals (Kinds of proposals, Standard formats for proposals, etc.). Strategies for making the proposal persuasive. Writing lab reports, project reports, and journal articles. Standard formats for research reports. Principles of structuring the report. Strategies for presenting data logically and persuasively. Writing abstracts (Kinds of abstracts; structuring the abstract, Strategies for making the abstract concise, specific, and detailed). Academic writing (research significance, flow, making claims and argumentation model). Maintaining objectivity. Using jargon, Presenting equations. Rhetorical principles and conventions of presenting data graphically. Documenting the scientific paper. Presenting scientific material to a lay audience. Ethics and Plagiarism.				

DS4103	Software Engineering	TH	-	-
Software Engineering concepts. Introduction to Software engineering frameworks. Requirements & Specification. Software Design. Software implementation. Software Testing & Quality Assurance. COTS & Reuse. CASE Tools. Software metrics & Reliability Assessment. CMMI. Team Organization & people management. Software Estimation. Software Maintenance. Software evolution.				

DS4104	Data Visualization	TH	PRS	-
Overview of Data Visualization. The Shapes of Data (Loading and Parsing Data with visualization libraries). Marks and Channels (Encoding Data with Marks and Channels). Visualization of Spatial Data, Networks and Trees. Using Color and Size in Visualization. Interaction Techniques. Multiple linked Views (Small Multiplies, Linked Highlighting with Brushing). Data Reduction (Histograms, Aggregating data, Hexbin Mapping, Cross- filtering).				

DS4105	Capstone Project in Data Science II	-	WS	PR
Capstone project II may involve investigation of data analysis and visualization techniques. This includes understanding the real-world problem, understanding the data set, data preparation, data modeling, validating, visualizing, and interpreting results. At the end of the year students will submit a progress report including the status of key stages of the project and results. Students will also rehearse a presentation for their mentor to practice for the end of programme presentation that will take place at the end of the second year.				

DS4106	Applied Data Mining	TH	PRS	-
Clustering Algorithms: K-mean, Agglomerative algorithm. Classification Algorithms: Decision Tree, Support Vector Machine. Association rule mining. Topic extraction. Practical: Implementation of datamining algorithms using python and Weka tools.				

DS4107	Social and Professional Issues in Computing	TH	-	-
History of computing, social context of computing. Methods & tools of analysis: consequence, duty and right based ethical theories. Professional & ethical responsibility. Risks & liability of computer-based systems. Intellectual property, privacy & civil liberties. Computer crime, customs & law. Economical issues in computing. Philosophical frameworks.				

DS4108	Business Intelligence	TH	-	-
Decision Support Systems and Business Intelligence: Business Environment Factors (markets, consumer demands, technology, and societal, etc.), Decision Support Frameworks (Degree of Structuredness vs. Types of Control), Automated Decision Making, Evolution of BI Capabilities, DSS & BI Architectures, Styles and Benefits of BI, Elements of a Work Systems, Major Tool Categories for Management Support Systems. Decision Making, Systems, Modeling, and Support: Introduction to Decision Making Disciplines, Characteristics of Decision Making and Decision Styles, Types and Benefits of Decision-Making Models, Decision-Making Process, New Technologies to Support Decision Making, Key Data Issues and Key Ingredients of Data (Information) Quality Management. Decision Support Systems Concepts, Methodologies, and Technologies: DSS Characteristics and Capabilities, DSS Classifications, Major DSS Components and Web Impacts, Future/current DSS Developments. Emerging Trends and Impacts: RFID and BI (RFID for BI in Supply Chain, RFID + Sensors for Better BI, etc.), Reality Mining and Virtual Worlds in BI applications, Web X.0 Revolutions, Virtual (Internet) Communities and Types, Online 62 | P a g e Social Networking and Social Network Analysis, Implications of Business and Enterprise Social Networks, Cloud Computing and BI, Issues of Legality, Privacy and Ethics. Collaborative Computer-Supported Technologies and Group Support Systems: Why (business) collaboration is difficult?, Time/Place Communication Framework, Groupware for (business) collaboration, Group Support Systems and Important Features, GSS Enabling Technologies, Collaborative Planning, Forecasting, and Replenishment (CPFR) and Collective Intelligence, Introduction to Taxonomy of Collective Intelligence.				

DS4109	Discrete Mathematics	TH	-	-
Theory and Logic: Fundamental concepts (set inclusion-exclusion and equalities), Functions (injective, surjective, bijective) and Relations, Equivalence relations and Equivalence classes, Countable, uncountable and well-ordered sets, Axiom of choice, Zorn's Lemma. Graph theory: Types of graphs, Isomorphism of graphs, Matrix representation of graphs, Eulerian and Hamilton graphs, Tree, spanning trees, Breath-first and Depth first algorithms, Kruskal's and Prim's algorithms, Directed graphs, vertex/edge connectivity, Network flow Applications. Counting: Different ways of counting, Double counting, Pigeonhole principle, Recurrence				

relations and their solutions, Modeling with recurrence relations, Generating functions.

DS4110	Artificial Intelligence	TH	-	-
Introduction: Practical examples of Artificial Intelligence, Intelligent Agents, Environments, Intelligent behaviour, Rational behaviour & Turing test. Problem solving by Searching: Problem-Solving Agents, Uninformed Search Strategies, Informed (Heuristic) Search Strategies. Local search and optimization algorithms: Hill climbing search, Simulated annealing, Local beam search, Genetic algorithms, searching in different environments, adversarial search. Planning: Classical planning, planning as state-space search. Learning Methodologies: Learning by Analysing Difference, by Recording Cases, by Correcting Mistakes, by Building Multiple models, by Building Identification Tree. Knowledge representation: Ontology engineering, Categories and objects, events. Natural Language Processing: Language models, Text classification, Information retrieval, Information extraction.				

DS-EAP-2201	Academic English II	TH	-	-
Refer English Curriculum (Page 88 & 89)				

Semester V				
DS5101	Semantic Web	TH	-	-
Introduction to semantic web. Data model: Extensible Markup Language (XML), Web Data Management with XML, XPath and XQuery. eXtensible Stylesheet Language Transformations (XSLT). Web Data Semantics and Integration: RDF, RDF2, OWL, OWL2, Ontologies -1, Ontologies -2. Introduction to SWRL.				

DS5102	Time Series Analysis and Forecasting	TH	-	-
Descriptive methods, plots, smoothing. Differencing: autocorrelation function, the correlogram and variogram. Periodogram: Estimation and elimination of trend and seasonal components, Stationary processes. Modeling autoregressive moving average (ARMA) models: ARIMA Models Identification, Building ARIMA models, estimation and diagnostic checking, forecasting.				

DS5103	Information Security	TH	-	-
Fundamental aspects of security: CIA, security mindset, design principles, system/security life cycle. Security Implementation Mechanisms (Guards, Gates, Cryptography, steganography). Information Assurance Analysis Models (Threats, Vulnerabilities, Attacks, Countermeasures). Disaster and Recovery. Security Mechanisms: Cryptography, Authentication, Redundancy, Intrusion Detection. Operational Issues: Trends, Auditing, Cost-Benefit analysis, Asset Management, Standards, Enforcements, Legal Issues. Policy: Creation & Maintenance of Policies, Prevention, Avoidance, Domain, Integration. Attacks: Social Engineering, Denial of Service, Protocol Attacks, Active & Passive Attacks, Buffer Overflow Attacks, Malware. Forensics: Legal Systems, Digital Forensics, Rules of Evidence, Search & Seizure, Digital Evidence, Media Analysis.				

DS5104	Machine Learning	TH	-	-
Introduction: Definition of learning systems. Goals and applications of machine learning. Aspects of developing a learning system: training data, concept representation, function approximation. Computational Learning Theory: Models of learnability: learning in the limit; probably approximately correct (PAC) learning. Sample complexity: quantifying the number of examples needed to PAC learn. Computational complexity of training. Sample complexity for finite hypothesis spaces. PAC results for learning conjunctions, kDNF, and kCNF. Sample complexity for infinite hypothesis spaces, VapnikChervonenkis dimension. Artificial Neural Networks: Neurons and biological motivation. Linear threshold units. Perceptrons: representational limitation and gradient descent training. Multilayer networks and backpropagation. Hidden layers and constructing intermediate, distributed representations. Overfitting, learning network structure, recurrent networks. Ensemble Learning: Using committees of multiple hypotheses. Bagging, boosting, and DECORATE. Active learning with ensembles. Bayesian Learning: Probability theory and Bayes rule. Naive Bayes learning algorithm. Parameter smoothing. Generative vs. discriminative training. Logisitic regression. Bayes nets and Markov nets for representing dependencies. Language Learning: Classification problems in language: word-sense disambiguation, sequence labeling. Hidden Markov models (HMM's). Veterbi algorithm for determining most-probable state sequences. Forward-backward EM algorithm for training the parameters of HMM's. Use of HMM's for speech recognition, part-of-speech tagging, and information extraction. Conditional random fields (CRF's). Probabilistic context-free grammars (PCFG). Parsing and learning with PCFGs. Lexicalized PCFGs.				

DS5105	Linear Programming	TH	-	-
Introduction to linear programming. The geometry of linear programming. The simplex method. Duality theory. Sensitivity analysis. Network flow problems. Interior point methods. Convex Analysis. Game Theory. Regression. Structural Optimization. The KKT System. The Homogeneous Self-Dual Method. Integer Programming.				

DS5106	Graph Theory	TH	-	-
Fundamentals: Subgraphs, Degrees of Vertices, Paths and Connectedness, Line Graphs. Directed Graphs: Basic Concepts, Tournaments, k-Partite Tournaments. Connectivity: Vertex Cuts and Edges Cuts, Connectivity and Edge Connectivity, Blocks, Cyclical Edge Connectivity of a Graph, Menger's Theorem. Trees: Centres and Centroids, Counting the Number of Spanning Trees, Cayley's Formula, Cayley's Formula. Independent Sets and Matchings, Vertex-Independent Sets and Vertex Coverings, Edge-Independent Sets, Edge-Independent Sets, Matchings and Factors, Matchings in Bipartite Graphs, Perfect Matchings and the Tutte Matrix. Eulerian and Hamiltonian Graphs: Pancyclic Graphs, Hamilton Cycles in Line Graphs, 2-Factorable Graphs. Graph Colorings, Vertex Colorings, Critical Graphs, Homomorphisms and Colorings, Triangle-Free Graphs, Edge Colorings of Graphs. Planarity: Planar and Nonplanar Graphs, Euler Formula, Kuratowski's Theorem, Hamiltonian Plane Graphs. Triangulated Graphs: Perfect Graphs, Triangulated Graphs, Interval Graphs, Circular Arc Graphs.				

DS5107	Image Processing	TH	-	-
Introduction to image processing, Elements of a digital image processing system. Image acquisition, storage, processing, transmission, and display. Image processing fundamentals; human vision system. Sampling and quantization (spatial and brightness resolution). Pixels and their relationships. Digital image processing techniques; image enhancement and restoration, pixel point processing, pixel group processing, frequency domain processing (Fourier transform). Image analysis. Coding systems; error detection and correction. Data compression schemes.				

DS5108	Mobile Computing	TH	-	-
Introduction to Mobile Computing Concepts, Characteristics of Mobile Computing. Cellular Mobile Communication, Evolution of Cellular Communication Technology Cellular Mobile Technologies: GSM, GPRS, UMTS, LTE. Wireless Networking for Cellular Mobile Communication: MAC Protocols, Mobile Internet Protocol, Mobile Transport Layer, Data storage on the device, Record Management System, SMS-Databases and other options, Location based services, Bluetooth integration. Mobile Operating Systems Architecture, Popular Mobile Operating Systems. Mobile Application Development Protocols: Java Clients, Mobile Ecosystem, Networking Java clients, Connectivity with mobile to consume services and send data. Business model development and Mobile Commerce. Social and professional issues of Mobile computing.				

DS5109	Data Science for Bioinformatics	TH	-	-
Introduction to Bioinformatics. Archives and information retrieval (Database search). Sequence alignment (Types, alignment methods, sequence search), multiple sequence alignment. Phylogeny. Gene prediction. Bioinformatics algorithms (Clustering; K-means, Hierarchical). Genomic data analysis. Workflow systems for bioinformatics. Future trends of bioinformatics.				

DS5110	Human Resource Management	TH	-	-
Uniqueness of Human Resource, Human Resource Management, Purpose of HRM, Importance & Responsibility for functions of HRM, Jobs, job designing & Job analysis. The necessity for Job re-designing, Job redesigning methods, Alternative work schedules. Value of Job Analysis, Job Description & Job Specification, HR Planning, HR Planning Process Recruitment & process of recruitment, Employer branding, New trends in recruitment – Active Sourcing/SNS recruitment. Significance of employee selections, Selection methods & selection process, Errors in employee selection Process of hiring, Probationary period, Employee orientation. Definition of Employee Performance Evaluation (EPE), Significance of EPE, EPE methods, Developing PE system. Definition–Learning, Education, training, development, Learning Principles, Training needs analysis. Training programme designing, Effective implementation of training Programmes, Evaluation of training programmes. Reward & total reward, Basic Salary determination - Job evaluation, Pay survey, Performance based pay, Employee benefits, Legal provisions for reward management in Sri Lanka. Grievance Handling (GH), Importance of GH, Methods of GH, Practical tips in HG. Discipline management, Hot Stove Model, Misconducts, Domestic Inquiry. The concepts of occupational health & safety, Hazards & factors				

affecting health & safety, Interventions for improving health & safety. Human Resource Information Systems. Green HRM, HR Analytics, HR Scorecards.

DS5111	Parallel and Distributed Computing	TH	-	-
Introduction to Parallel & Distributed Programming (definitions, taxonomies, trends). Parallel Computing Architectures, Paradigms, Issues, & Technologies (architectures, topologies, organizations). Parallel Programming (performance, programming paradigms, applications). Parallel Programming Using Shared Memory I (basics of shared memory programming, memory coherence, race conditions & deadlock detection, synchronization). Parallel Programming Using Shared Memory II (multithreaded programming, OpenMP, pthreads, Java threads). Parallel Programming using Message Passing - I (basics of message passing techniques, synchronous/asynchronous messaging, partitioning & load-balancing). Parallel Programming using Message Passing - II (MPI), Advanced Topics (accelerators, CUDA, OpenCL, PGAS). Introduction to Distributed Programming (architectures, programming models). Distributed Programming Issues/Algorithms (fundamental issues & concepts - synchronization, mutual exclusion, termination detection, clocks, event ordering, locking). Distributed Computing Tools & Technologies I (CORBA, JavaRMI). Parallel & Distributed Computing – Trends & Visions (Cloud & Grid Computing, P2P Computing, Autonomic Computing).				

Semester VI				
DS6101	Introduction to Deep Learning	TH	PRS	-
Probability and Information Theory for Deep Learning. Deep feedforward networks. Regularization in deep networks. Optimization for training deep models. Convolutional Neural Networks. Practical: Exercises on CNN, solving a problem with CNN on TensorFlow.				

DS6102	Bayesian Learning and Graphical Models	TH	PRS	-
Bayes rule and distributions. MLE and Bayesian learn. Patterns – clustering. Bayes nets. Variable elimination. Inference parameters. Structure Learning. Undirected graphical models.				

SE6103	Mathematical Optimization	TH	-	-
Linear programming (LP): Mathematical formulation of the LP problem, Graphical solution method, Simplex method, Two-phase simplex method, Interior-point method, Duality in LP, Duality theorems, Dual-simplex method. Network Model: Introduction to network models, Transportation Problem, Assignment problem, Shortest path problem. Advanced Linear Programming: Dantzig-wolf decomposition algorithm, Goal programming. Integer programming: Branch-and–bound, Cutting planes. Non-linear programming: Kuhn-Tucker conditions, Dynamic Programming, Quadratic programming. Non-traditional Optimization algorithms: Simulated Annealing (SA), Genetic Algorithm (GA). Modeling Practice: Modeling in the Real World.				

DS6104	Industrial Training	-	-	THS
Students will be required to complete industrial training related to Data Science at				

a relevant industry or research institution. The duration of the project period should be a minimum of 15 weeks. A project report should be submitted at the end of the semester & should be presented & defended by the respective student in front of an evaluation panel appointed by the department.

DS6105	Web Services	TH	PRS	-
Students will be required to complete industrial training related to Data Science at a relevant industry or research institution. The duration of the project period should be a minimum of 15 weeks. A project report should be submitted at the end of the semester & should be presented & defended by the respective student in front of an evaluation panel appointed by the department.				

DS6106	Cloud Computing	TH	PRS	-
Cloud Computing Concepts: Introduction to cloud computing, Properties, characteristics & disadvantages, Gossip, Membership & Grids, P2P Systems, Key-Value Stores, Time & Ordering Classical Distributed Algorithms. Cloud Systems & Infrastructure: Cloud computing stack, Service model, Deployment models, Containers, virtual machines, MAAS, PAAS, Web Services. Storage: Ceph, SWIFT, HDFS, NAAS, SAN, Zookeeper. Big Data & Applications in the Cloud: Spark, Hortonworks, HDFS, CAP, Streaming Systems, Graph Processing & Machine Learning. Cloud Resource management & Service management in cloud computing. Cloud Networking: Introduction to cloud networking SDN with cloud, Data center networking. Cloud security: Identity & Access management, Access control, Authentication in cloud computing. Developing application in cloud platform, Introduction to Cloud Computing with AWS, Azure google's cloud platform. Research trends in cloud: Edge & Fog computing, cloud & IoT. Practical: Hands on experience using a cloud-based tool.				

DS6107	Business Process Management	TH	-	-
Business Processes (basic concepts, modeling). Design, analysis, verification & refinement methods. Workflow Systems (organization & architecture). Synchronization, control, communication & monitoring of process enactment. Workflow Analysis. Workflow Patterns. Workflow development tools & software.				

DS6108	Software Quality Assurance	TH	PRS	-
Introduction to Software Quality and Software Quality Assurance (SQA). The components of the software quality assurance system, Software project life cycle components, Infrastructure components for error prevention and improvement, Management SQA components, SQA standards, system certification, and assessment components. Testing Concepts Definition, Types and Levels of testing, Black vs. White Box testing. Test Techniques, White Box techniques, Black Box techniques, Test Planning. Test Design Specifications, Test Cases, Test Metrics, Pre-process metrics: Estimation, In-process metrics: Process Management, End-process metrics: Process Improvement. Test Management, Test planning, resource management, test reporting, tools. Test Automation: Web test automation, Mobile test automation, Test script writing. SQA Standards, certification and assessment. Organizing for quality assurance, Management and its role in software quality				

assurance. Practical: Hands on experience with a SQA Tool for authoring functional tests.

DS6109	Fraud and Anomaly Detection	TH	PRS	-
An Introduction to anomalies. Probabilistic and Statistical models for anomaly detection. Linear models for anomaly detection. Supervised anomaly detection. Deep learning-based anomaly detection. Anomaly detection in categorical and high-dimensional data. Mining anomalies in graph data. Time series and multidimensional streaming anomaly detection.				

Semester VII				
DS7101	Research Method	TH	-	-
Introduction to the notion of research. Literature review. Research designs. Identifying data requirements, sources, & instruments for data gathering. Undertaking 'experiments'. Validation: Types of validation. Analysing research data. Writing Strategies. Ethical Consideration.				

DS7102	Advanced Deep Learning	TH	PRS	-
Recurrent and recursive deep networks. Linear factor models. Generative Deep Learning: Auto encoders, Variational encoders, Generative adversarial networks, Neural transfer. Representation Learning. Deep Learning Research and their applications. Practical: Exercises on RNNs, solving a problem with RNNs on TensorFlow.				

DS7103	Emerging Trends in Data Science	-	-	PR
Systematic literature review will be conducted by the student independently.				

DS7104	Numerical Methods	TH	-	-
Solving Nonlinear Equations. Linear Interpolation Methods. Solving Sets of Equations. Interpolation and Curve Fitting. Approximation of Functions. Chebyshev Polynomials and Chebyshev Series. Rational Function Approximation. Numerical Differentiation and integration. Numerical Solution of Ordinary. Differential Equations. Optimization. Partial-Differential Equations. Finite Element Analysis.				

DS7105	Natural Language Processing	TH	-	-
NLTK, Python 3 and the Jupyter Notebook, Introduction to HPC. Textual Sources and Formats, APIs, Social Media, Web Scraping. Tokenization, N-grams and Scriptio continua, Stemming and Lemmatization, Synsets and Hypernym. POS Tagging and Stopwords. Text "Features" and TF-IDF Classification. Named Entity Recognition (NER). Sentiment Analysis. Topic Modeling Basics, Topic Modeling; Strengths, Weaknesses, Correlations. Document Clustering and Word Vectors, Doc2vec, Word2vec, Advanced Vector Analysis. Dependency Parsing & Constituency Parsing.				

DS7106	Entrepreneurship and Innovation	TH	-	-
Role of entrepreneurs in national development. Training of entrepreneurs. Essential characteristics of techno-entrepreneurs. Business proposal & assessing criteria.				

Making business proposals. Technology & innovation: Invention, Commercialization & Diffusion, Technology push & market pull. Business models for innovation.				

DS7107	Internet of Things	TH	-	-
Introduction to IoT (Sensing, Actuation, Basics of Networking). Sensor Networks: Machine-to-Machine Communications.: Interoperability in IoT. Introduction to Arduino Programming, Integration of Sensors and Actuators with Arduino. Introduction to Raspberry Pi, Implementation of IoT with Raspberry Pi. SDN for IoT. Data Handling and Analytics. Connected Vehicles, Smart Grid, Industrial IoT. Industrial IoT Case Study: Agriculture, Healthcare, Activity Monitoring, Smart cities, Smart homes.				

DS7108	Design Patterns and Anti-Patterns	TH	PRS	-
Introduction to Design Patterns: A Brief History, How Design Patterns Solve Design Problems, How to Select & Use a Design Pattern. The Catalog of GoF (Gang-of-Four) Design Patterns. Creational Patterns: Abstract Factory, Factory Method, Singleton. Structural Patterns: Adapter, Composite, Decorator. Behavioral Patterns: Observer, Strategy, Template Method Pattern. Model-View-Controller (MVC) Pattern. Design Principles for creating software that is flexible, reusable, and maintainable. Symptoms of bad design (anti-patterns). Practical: Hands on experience in modeling using a UML professional design software and OOP programming.				

DS7109	Ontology Engineering	TH	PRS	-
Introduction to Knowledge Representation and the Semantic Web. Introduction to the Web Ontology Language OWL. Description logics and classifiers. Description Logics Syntax, Semantics, and reasoning problems. Methods for developing and evaluating ontologies. Common problems and patterns in ontology development. Application development using the OWL API. Practical: Introduction to Protege and OWL including advanced tutorial, Special problems of representation and reasoning in OWL, Practical individual development project using Java, Critique/comment on implemented ontologies on the Web.				

DS7110	Blockchain and Cryptocurrency	TH	-	-
Intro to cryptography & cryptocurrencies. Technological and Cryptographic Elements in Blockchain, Blockchain Platforms. Consensus: network models, corruption tolerance. Ethereum: Decentralized Apps, EVM, and the Ethereum blockchain. Decentralized finance and economics. The Limitations, Opportunities and Challenges of Blockchain. Privacy on a public blockchain, Legal Regulations for Blockchain.				

Semester VIII				
DS8101	Research Project in Data Science	-	-	THS
The course starts with a reflection and discussion about interdisciplinary research, where students define their research topics. Throughout the course, the students				

work in developing their research questions and choose the appropriate methodological approaches for their research and analyze the results. Students should be able to provide valid findings in selected research domains and report in a format of thesis and submit it to the department. They are encouraged to present their findings in local and international research forums.

DS8102	Information Retrieval and Web Analytics	TH	-	-
Introduction to IR. Basic IR Models. Basic Tokenizing, Indexing, and Implementation of Vector-Space Retrieval. Performance metrics: recall, precision, and F-measure; Evaluations on benchmark text collections. Relevance feedback; Query expansion; Query languages. Text Representation and clustering. Recommender Systems. Ethical Issues in IR. Web search. Introduction to Web Analytics. Basic Segmentation, Intermediate Metrics, Custom Metrics, Calculated Metrics. How to use Adobe Analytics, IBM Core metrics and Google Analytics.				

DS8103	Reinforcement Learning	TH	-	-
Introduction. Bandit problems and online learning. Markov decision processes. Returns, and value functions. Dynamic programming. Monte Carlo learning. Temporal difference learning. Eligibility traces. Value function approximation (function approximation). Models and planning (table lookup case).				

DS8104	Computational Intelligence	TH	-	-
Introduction to Computational Intelligence (Important literatures on the topic of artificial neural networks (ANN), general concept of ANN, different types of ANN, different types of learning (supervised and unsupervised learning), and applications of ANN algorithms in real world). Genetic Algorithms (General concept and features of GAs, different types of GAs, different strategies of using GA features, and applications of GA algorithms in real world). Swarm Optimization (General concept and features of swarm optimization, different types of swarm optimization algorithms and their concepts/features, and applications of swarm optimization algorithms in real world). Fuzzy Systems (Important literatures on the topic of fuzzy systems, general concept and features of fuzzy systems, different strategies for using features of fuzzy systems, and applications of fuzzy systems in real world). Hybridization of CI Algorithms (Important literatures on the topic of hybridization of computational intelligence algorithms, why such hybrid algorithms can be beneficial, the general concepts of how to combine algorithms, different types of hybrid algorithms and their benefits, and applications of such hybrid algorithms in real world).				

DS8105	Business Analytics and Applications	TH	-	-
Introduction to business analytics. Finance Analytics. Marketing Analytics. Supply Chain Analytics. Human Resources Analytics. Customer Relationship Management Analytics. Manufacturing Industry Analytics.				

DS8106	Geographical Information Systems	TH	PRS	-
Introduction to GIS - What is Geographic Information Systems, Different components of GIS, Different types of vector data, Raster data models & their types, TIN data model. Data Representations - Advantages & disadvantages associated				

with vector, raster & TIN, Non-spatial data (attributes) & their type, Raster data compression techniques, Different raster data file formats, Spatial database systems & their types. Map Projections - Pre-processing of spatial datasets, Different map projections, Spatial interpolation techniques, Different types of resolutions, Digital Elevation Model (DEM). Geographic Phenomena. Practical: Hands on experience with GIS, Hands on experience with different spatial related APIs (Geo Coding API, LocationIQ API, Google Maps API etc.).

DS8107	Digital Forensics	TH	-	-

Basic principles and methodologies for digital forensics, Design systems with forensic needs in mind. Rules of Evidence – general concepts and differences between jurisdictions and chain of custody, Search and seizure of evidence: legal and procedural requirements. Techniques and standards for preservation of data. Legal and reporting issues including working as an expert witness, OS/File system forensics - Windows, mac, android etc. Application, Web, Network and Mobile forensics - Network forensics: provides the tools to collect information regarding network traffic. Attack detection and investigation. Methods to detect and investigate cyber-attacks, Anti-forensics. Any tools or software that is used to disrupt a computer investigation.

DS8108	Business Process Simulation	TH	-	-

Simulation in management decision making. Queuing theory. Concepts of discrete-event simulation. Construction of models: Modeling issues, Verification & Validation of models. Practical: Use of computer simulation tools.

DS8109	Robotics	TH	PRS	-

Fundamentals of Robotics. Modern robotics: manipulator robots. Mechanics of manipulator robots: position and orientation. Direct and inverse kinematics, static forces and speeds. Singularities, dynamics. Matlab modeling of a manipulator's kinematics and dynamics. Manipulator robots' control: trajectories. Digital control: Synthesis, Syntony and analysis of PID controllers. Structures and sensors. Manipulator robots' programming: languages. Off-line and on-line programming; remote access: Monitoring and Supervision. Fundamentals of Bionics. Human-machine interface systems. Practical: Applications in clean/laboratorial environments, automated guided vehicles.

Rules and regulations

1. Students should complete (obtain at least D+ grade) the credited, compulsory and non-GPA courses General English I, General English II, Academic English I, Academic English II, Business English and Academic Integrity to be eligible for the award of the BScHons (DS) degree.
2. Capstone project II (DS4106) may involve investigation of data analysis and visualisation techniques and there will be regular progress presentations from Semester III to the end of the Semester IV.
3. Students should select Two (02) elective subjects to cover Four (04) credits during the Semester V, and VII.
4. Students should select One (01) elective subject to cover Two (02) credits during the Semester VI, and VIII.
5. Industrial Inspection (DS5109) is compulsory one credited subject and a visit to Three (03) industrial sites will be organized during the Semester V. A report should be submitted after the industrial site visit.
6. For Industrial Training (DS6104) students should attend the Industry Placement in Semester VI, which is compulsory for all. Also, students should submit an Internship Placement Offer Letter to the Department before the commencement of Semester VI. Along with the Industrial Training, students must also complete Three (03) compulsory courses (DS6101, DS6102, DS6103) and one elective course (chosen from DS6105, DS6106, DS6107, DS6108, and DS6109). Courses will be conducted online mode.
7. For Research Project in Data Science (DS8101), students should submit the Research Proposal for the BSc Research Project in Data Science during the first part of the semester VII through the course Research Method (DS7101) and the Research will commence thereafter and there will be regular progress presentations from Semester VII to the end of the semester VIII. This is completely a research project and not an internship in the industry.
8. Depending on the availability of the resources, elective courses will be conducted in Semesters V, VI, VII, and VIII.
9. To offer elective subjects, there should be 10% of students registered for the course.

ENGLISH CURRICULUM

The English Curriculum of the Faculty of Computing is made up of three components: General English, Academic English, and Business English. It aims to make the students confident in using the language appropriately with fluency and accuracy coupled with communicative competence and performance.

General English

The General English programme, consisting of two parts as General English I and General II, is conducted in the first academic year as a non-credited non-GPA compulsory component for the B.Sc. degree programmes in the Faculty of Computing. These two parts are evaluated separately.

This General English curriculum is designed to help students make rapid progress in English and focus on the four key language skills – reading, writing, listening, and speaking – with additional work on vocabulary, grammar, and pronunciation. This curriculum is common to all five Departments in the Faculty of Computing.

The duration for teaching General English Curriculum is two semesters in the first academic year which consists of 30 weeks. Two hours are allocated per week to complete the lessons outlined in the curriculum.

Academic English

Academic English programme, consisting of two parts as Academic English I and Academic English II, is conducted in the second academic year as a non-credited non-GPA compulsory component for the B.Sc. degree programmes in the Faculty of Computing. These two parts are evaluated separately.

Academic English uses an established formal tone. Students are expected to master the technical vocabulary specific to their course of studies. General English aims to achieve a high standard of everyday English communication skills while the Academic English curriculum is designed for students to excel in their academic activities.

This Academic English curriculum introduces students to academic study skills in their chosen field of study. Different resources will be used for the process of teaching and learning in the five Departments considering the specific needs of each degree programme.

The duration for teaching Academic English Curriculum is two semesters in the second academic year which consists of 30 weeks. Two hours are allocated per week to complete the lessons outlined in the curriculum.

Business English

Business English is the type of English used in business contexts, such as international trade, commerce, finance, insurance, banking, and many other office settings. It entails expectations of clarity, particular vocabulary, and grammatical structures. When using English for business contexts, it is vitally important to be as clear as possible and leave nothing for different interpretations. This is different from literature, for example, where a lot is left up to the interpretation of the reader. A sound grasp of Business English enables the student to communicate in English more effectively and fluently during day-to-day workplace scenarios such as presentations, negotiations, meetings, small talk, socializing, writing reports and C.V writing etc.

This Business English curriculum is common to all the Departments except in certain areas that use specific learning materials from different degree programmes. The Business English programme is conducted in the third year first semester (15 weeks) as a non-credited non-GPA compulsory component for the B.Sc. degree programmes in the Faculty of Computing. Two hours are allocated per week to complete the lessons outlined in the curriculum.

Teaching Methodology

Portfolio submissions, Lectures, Brainstorming sessions, Case-based learning, Concept maps, Expert speaker, Game-based learning, Interviews, Problem-based learning, Project-based learning, Readings, Role-play, Scenario comparison, Simulation, Discussion sessions, Quizzes, Assignments, Debates, Presentations, and Examinations.

Evaluation Procedure

The ILOs of the course will be assessed through the following components with the given weightages:

Continuous Assignments on four language skills:	40%
End Semester Examination (a three-hour written examination):	60%

The pass mark is 40% (D+).

Other examination rules, regulations and practices observed in the Faculty of Computing will apply to this programme as well.

Detailed Curriculum

The detailed English curriculum of the Faculty of Computing is available at https://www.sab.ac.lk/computing/undergraduate/english-curriculum

EXAMINATION CRITERIA

General

A student who satisfies the following conditions will be awarded a degree of BSc Honours in (Information Systems/Software Engineering).

- Be registered at the University as a candidate for the relevant degree Programme.
- Have completed the Programme of studies for each Semester to the satisfaction of the Senate.
- A satisfactory completion of the Programme of studies will include at least 80% attendance for tutorials and practical assignments, etc.

Every registered student who wishes to sit the examination should submit an application in the appropriate form within the stipulated period. Each eligible student will be issued an admission card/form to sit the relevant examination.

Every candidate should sit the examination in respect of all the relevant subjects studied during the semester.

A candidate will be given a question paper for each subject at the examination conducted at the end of the semester, which is called the End Semester Examination.

The End Semester Examination of each subject will carry a minimum of 60% of the final marks. An appropriate proportion of marks not exceeding 40% will be assigned to Mid Semester Examination and/or Assignments and/or Quizzes that are conducted throughout the semester (i.e. continuous assessment). Finally, the subject is evaluated at the end of the semester based on all above-mentioned evaluations, totalling up to 100 marks. However, depending on the course unit, the form of evaluation could be varied and will be informed prior to commencement of the course.

Grades and Grade Points

A letter grade shall be awarded to each course. The cut-off marks for each grade and the corresponding grade points are given in the below table.

Students can repeat the examination of a subject only twice for upgrading the grade of a course.

All E grades should be improved at the first available opportunity.

The maximum grade given for a repeated examination shall be C.

A student who obtains any grade less than a C has the option to repeat the exam of a subject and upgrade to a maximum of C.

In granting a grade at a successful repeat examination, all previous less satisfactory grades will be eliminated and a "pass grade" of "C" will be awarded at the successful attempt, irrespective of the marks scored by the candidate.

Grade	Marks	Grade Point
A+	≥ 90	4.00
A	80-89	4.00
A-	75-79	3.70
B+	70-74	3.30
B	65-69	3.00
B-	60-64	2.70
C+	55-59	2.30
C	50-54	2.00
C-	45-49	1.70
D+	40-44	1.30
D	30-39	1.00
E	≤ 29	0.00

Grade Point Average

The GPA of the year will be computed as the sum of the products of the credits assigned per year and the grade point granted for each subject divided by the total number of credits assigned per year.

$$\textbf{Grade Point Avarage (GPA)} = \frac{\sum_{i=1}^{n} GP(i).CP(i)}{N}$$

n = *Number of Subjects assigned per year*
$GP(i)$ = *Grade Point of i^{th} Subject*
$CP(i)$ = *Credit Points of i^{th} Subject*
N = *Number of Credits assigned per year*

Example:

Subject	*Credit Points assigned (CP)*	*Grade*	*GradePoint (GP)*	*(CP)*(GP)*
I	*2*	*A^+*	*4.00*	*8.00*
II	*1*	*B^-*	*2.70*	*2.70*
III	*2*	*A^+*	*4.00*	*8.00*
IV	*2*	*C*	*2.00*	*4.00*
V	*1*	*A^+*	*4.00*	*4.00*
VI	*2*	*B^+*	*3.30*	*6.60*
VII	*3*	*B*	*3.00*	*9.00*
VIII	*3*	*A*	*4.00*	*12.00*
IX	*3*	*A*	*4.00*	*12.00*
	19			*65.30*

$$\sum_{i=1}^{n} \boldsymbol{GP(i).CP(i) = 65.30}$$

$$GPA = \frac{65.3}{19}$$

$$= \mathbf{3.43}$$

Final GPA (FGPA)

The Final GPA (FGPA) of the four-year degree Programme will be calculated considering the GPA of the year 1, year 2, year 3 and year 4, which will be weighted by 0.2, 0.2, 0.3 and 0.3 respectively, as well as the total number of credits earned in each year.

$$FGPA = \sum_{j=1}^{4} \left(a_j \times P_j\right)$$

a_j= 0.2, 0.2, 0.3 and 0.3 for j = 1st year, 2nd year, 3rd year and 4th year respectively.

P_j= GPA in year j

The FGPA will be rounded to the second decimal place, and the FGPA for the degree Programme will be calculated at the completion of all requirements for the degree.

Pass

A candidate must obtain at least the minimum grade (D) for all credited GPA courses (compulsory/elective) in each semester securing FGPA ≥ 2 at the end of the degree Programme to complete the degree and to be eligible to award of a degree certificate.

Award of Classes

Classes will be awarded on successful completion of the degree Programme, entirely on the Final GPA (FGPA) of the student, on the following basis:

FGPA	CLASS AWARDED
4.00 - 3.70	FIRST CLASS
3.69 - 3.30	SECOND CLASS (UPPER DIVISION)
3.29 - 2.70	SECOND CLASS (LOWER DIVISION)
2.69 - 2.00	PASS

Student Awards

Thambippillai Thambiratnam (J.P.U.M) – Attorney-at-Law Memorial Gold Medal *(Awarded by Prof. S. Vasanthapriyan)*
Awarded to the student with the best performance in Computing and Information Systems

Best Undergraduate Researcher of Computing Gold Medal *(Awarded by the Academic Staffs of Department of Computing & Information Systems)*
Awarded to the student who has the highest number of research publications, patents received during the undergraduate studies and having the minimum overall GPA of 3.3.

EXAMINATION PROCEDURES, OFFENCES AND PUNISHMENTS

Rules & Regulations governing the holding of Examinations

- Candidates should be at the examination hall 15 minutes before the commencement of the relevant examination. They should enter the examination hall only when informed to do so by the supervisor.
- After entering the examination hall, the candidates should be seated at the desk/table bearing their Index No.
- Candidates are permitted to bring useful items such as pens, pencils, erasers, ink, rulers, geometrical instruments, coloured pencils etc. to the examination hall. No candidate is allowed to bring in any written paper or notes or any other items, including electronic devices and items, which may be misused at the examination.
- Candidates are not allowed to enter the examination hall 30 minutes after the commencement of an examination and they will not be allowed to leave the examination hall before the lapse of 30 minutes from the commencement of the examination and during the last 15 minutes of the examination.
- Every candidate must bring the Examination Entry Form, Student Record Book and the Student Identity Card to the examination hall. While the Student Record Book and the Identity card should carry the student's photograph and signature, it should also be certified either by the Registrar or an officer authorized by the Registrar. If the names appearing in the Student Record Book/ Identity card and those in the Examination Entry form differs, the candidate has to submit an affidavit to the Registrar. In the event of such certification not being available, the candidate has to submit either the National Identity Card or a recent photograph certified by an authorized officer.
- When requested by the Supervisor of the examination, candidates must surrender all documents in their possession.
- No candidate should ask another for anything, exchange anything, engage in conversation, copy from another or help or encourage another candidate to copy.
- Candidates should write their answers in the answer sheets or answer books issued on the particular date of the examination.
- Writing paper such as answer sheets, graph paper, drawing paper, ledger and journal sheets required by the candidates will be issued to them at the examination center. Candidates are advised not to tear, bend crumple or destroy any paper or answer sheet given to them. Writing paper issued only by the supervisor should be used at the examination. Log tables should be

used carefully and left on the table after use. All stationery supplied to the candidates, both used and unused, should be left on the desks when candidates leave the examination hall.

- Before answering the question paper, candidates should write their Index No. and the name of the examination in the relevant place in the answer script. The Index No. Should also be written in all other sheets used for answering questions. No candidate should write his/her name or place any identification mark on the answer script. It should also be noted that using the Index No. of another is a breach of examination rules.
- All paper used for rough work should be crossed with a line and annexed to the answer script. Rough work should not be done on the Examination Entry Form, timetable or question paper.
- All candidates must maintain strict silence both inside and outside the examination hall and not disturb the supervisor, invigilators and other candidates.
- Except for a practical or field note book or assignment written by himself/ herself, no candidate is allowed to submit any other document written partly or wholly by someone else, with the answer script.
- Impersonation of any kind is strictly prohibited.
- The supervisor or the invigilators have the authority to call for a written statement from a candidate regarding any incident that takes place in the examination hall. Candidates should not refuse to make such a statement or sign such a statement.
- Answer scripts should be personally handed over to the Supervisor or an Invigilator. Answer scripts should not be handed over to anyone else for whatever reason. All candidates should remain seated until all answer scripts are collected.
- Candidates must make sure that they don't have in their possession any written/printed document, note or device which can be misused at the examination. They must also ensure that they do not indulge in acts, which can give rise to their being suspected of misconduct at the examination.

Submitting Medical Certificates for Absence at the Examination

- Internal candidates who absent themselves for the whole or part of an examination due to ill health should report to the Medical Officer of the University about it either before the commencement of the examination or during the examination time.
- Candidates who fail to do so for unavoidable reasons must submit a medical certificate from a District Medical Officer or a Medical Officer attached to a government hospital, within 14 days of the commencement of the relevant

examination or part of the examination. Medical certificates issued by private medical officers; Ayurvedic physicians or Homeopaths are not accepted.

Examination Malpractices

- Possession of unauthorised documents.
- Copying
- Cheating
- Removal of examination stationery from the examination hall.
- Inappropriate behaviour
- Impersonation
- Gaining or attempting to gain unlawful access to the contents of a question paper.
- Aiding or abetting someone to cheat or receiving assistance from someone to cheat.
- Using undue influence on supervisors, invigilators and other examination officials.
- Any other action considered as an examination malpractice by the University Senate.

Procedure for Investigating Examination Malpractices

- The supervisor should report any examination malpractice to the Asst. Registrar (Examinations) who will investigate into the matter and submit a report to the sub-committee appointed by the Senate.
- On the recommendations submitted by the sub- committee, the Senate will impose appropriate punishment on the offenders.

Punishment for Examination Malpractices

Possession of unauthorised documents
Punishment:
Banning examination candidacy for a period of two years or imposing alternative punishment considered appropriate by the Senate.
Copying
Penalty:
Invalidating examination candidacy for a period of 3 years or imposing alternative punishment considered appropriate by the Senate.
Cheating
Penalty:
Cancellation of examination candidacy, debarring candidate from sitting for University examinations for a specific period or imposing any other punishment considered appropriate by the Senate.

Removing examination stationery belonging to the University

Penalty:

Cancellation of examination candidacy and debarring candidate from sitting for university examinations for a period specified by the Senate.

Inappropriate conduct

Penalty:

Cancellation of examination candidacy, debarring candidate from sitting for university examinations for a period not exceeding 05 years and imposing any other punishment considered appropriate by the Senate.

Impersonation

Penalty:

Annulment of candidacy for a period not less than 05 years and not exceeding 10 years and the imposition of any other punishment considered appropriate by the Senate.

Gaining illegal access or attempting to gain such access to the contents of a question paper

Penalty:

Cancellation of examination candidacy and imposing any other punishment considered appropriate by the Senate.

Aiding and abetting examination malpractices and receiving assistance to commit such malpractices

Penalty:

Cancellation of examination candidacy and imposing any other punishment considered suitable by the senate.

Attempting to unduly influence examination supervisors and other officials

Penalty:

Any punishment prescribed by the Senate.

Being guilty of an examination malpractice for the second time

Penalty:

Cancellation of registration as a student of the University.

Compulsory punishments

In addition to the punishments listed above, the following will also be imposed on the recommendation of the Senate:

- Withholding a class for the degree.
- Limiting the maximum marks obtainable to 40% when re-sitting cancelled question papers.
- Either cancelling or withholding scholarships and bursaries.
- Withdraw residential facilities.
- Withholding invitation to graduation ceremony
- Delaying graduation and the release of degree results by one year.

The senate will decide on the punishments to be imposed for any examination malpractice not mentioned above.

CODE OF DISCIPLINE FOR STUDENTS

Section I - General Students Discipline

Acts of Indiscipline and Insubordination

1. The conduct of every student should at all times be exemplary throughout his/her period of Studentship.
2. Every Student should apply himself to his academic work in such a manner as to satisfy the University. No student may absent himself from lectures or practical work for a period exceeding three weeks in one academic year unless he has obtained special permission or has a valid reason for such absence.
3. No student must commit any of the acts of indiscipline and insubordination listed below:
    a. Behaving in such a manner as to bring into disrepute or endanger the good name of the University: to obstruct the proper functioning of the educational, examination, or administrative activities of the University, to prevent or obstruct a member of the academic or non-academic staff, or an employee of the University from carrying out his duties: to ridicule or humiliate such person.
    b. Failure or inability to produce the students' record book, which will be issued to students, when called upon to do so by the Vice-Chancellor or the Registrar, or failure to identify himself/herself.
    c. Causing damage to university property, removing University property from the University premises, appropriating it to himself/herself or to another, defacing, dirtying, or defiling the buildings, walls or roads of the University by scratching, writing, drawing, or pasting posters upon them.
4. Causing, or aiding, abetting, encouraging, or sanctioning others to cause injury or harm to the self-respect or dignity of other students, staff officials, employees, or lawful visitors to the University, or causing loss, ridicule, danger, mental or physical pain to such person or persons.
5. Establishing, organizing, conducting or assisting in any activity an organization or society within the University, apart from those registered in terms of Clauses 112,114,115,116,117 and 118 of part III of the Universities Act No. 165 of 1978 as amended by the Universities (Amendment) Act. No. 7 of 1985.
6. Behaving is such a manner as to disturb or disrupt, or to gain admittance without permission, or to cause discomfort or harm to participants in any meeting, seminar, festival, procession, exhibition, cultural or social event,

which may have been organized with prior approval from the Vice-Chancellor by any society or organization which has been registered under the provisions laid out in Section (05) above.

7. Behaving in such a manner as to disturb or disrupt, or to gain admittance without permission, or to cause discomfort or harm to participants in, any meeting, seminar, festival, procession, exhibition, variety entertainment, play, film show, or religious, cultural or social event, which may have been organized with prior approval from the Vice-Chancellor of the University, or by the University administration, or by the academic or non-academic staff, or by an external organization.
8. Organizing, staging, encouraging, sanctioning, or participating in any meeting, seminar, festival, procession, exhibition, variety entertainment, play or film show held within the University premises or in its environs without the prior approval of the Vice-Chancellor of the University.
9. Holding meetings, picketing demonstrating, participating in processions, or fetes publishing, drawing, writing, putting up or distributing handbills, notices, or posters, or encouraging, sanctioning, or assisting others to commit such action, whether in favour of a university teacher, or an official, or an employee of the University, or in favour of some cause outside the University.
10. Ragging in any form. (N.B. any person found ragging is liable to be expelled from the University without any inquiry being held.)
11. Collecting, or encouraging to collect, or sanctioning the collection of money or any other item from students or employees or visitors of the University, or the retention or disbursement of such funds or items by any person, whether an Office bearer of a registered society or not unless it be with the full written consent of the ice-Chancellor.
12. Writing, printing, publishing, distributing, exhibiting, or pasting, either within the University or in its vicinity, any poster, notice, pamphlet, or other writings slanderous to any individual or detrimental to the reputation of the University, to discipline, or to peace.
13. Publishing, pasting, exhibiting, writing, or drawing, any notice or poster, in any place other than those authorized for such display, even if such action is in connection with the activities of a society registered with the University in terms of Clause 115 of Part of the Universities Act No 16 of 1978, as amended by the Universities (Amendment) Act No 7 of 1985, and even if such notice or poster has been approved by the Vice-Chancellor, the relevant teacher, or the Chief Students Counsellor.
14. Publishing, broadcasting, telecasting, or releasing to the mass media, whether by the student on his own responsibility, or on behalf or another student or

group of students, or on behalf of a society, any statement, article or notice, detrimental to the reputation of the University or insulting or humiliating the University authorities, or any official or employee of the University, or any other person connected with the University.

15. Consumption, distribution, sale or storage of drugs within or bringing such drugs into the University, or being under the influence of liquor or drugs within the University, or encouraging, assisting or sanctioning such action by any other person.
16. Consumption, distribution, sale or storage of liquor anywhere within the premises other than those permitted by the authorities.
17. Bringing into, or keeping, or storing within the University any weapon, explosives, or dangerous items, or encouraging or assisting such action.
18. Non-provision or the avoidance of provision of information needed by or requested by the University, or the provision of false or distorted information.
19. Abuse or misuse of university buildings, grounds, equipment or the property belonging to the University, or their use for unsuitable, unsanctioned, or improper purposes, or non-observation of the rules for their use.
20. Remaining within the University premises during times when the University is closed to students. (Such times may be subject to periodic changes.)
21. Any act for which the student could be convicted by a lawfully constituted court of law for an offence against the laws of the Republic of Sri Lanka.

Section II – Punishments

1. Any student found guilty of any offence specified as an act of indiscipline or insubordination in Section I above or of attempting to subvert the provision of this section (Section 11 - Punishments) may be subjected to one or more of the punishments listed below, as deemed sufficient by the Vice Chancellor, acting in accordance with the findings and recommendation of the Disciplinary Committee.
    a. A caution or a severe warning.
    b. A fine, not exceeding Rs.500/=
    c. Recovery of any loss sustained by the University. Suspension from classes, examinations, and from the use of all University facilities for a specified period.
    d. Suspension from sitting examinations of the University for an unspecified period.

e. Cancellation, postponement, or suspension of the release of examination results for an indefinite period

f. Regarded as having relinquished the course and/ or the studentship of the University.

g. Expulsion from the University. (The imposition of any one or more of the above punishments may be suspended. Note that the punishment for ragging will be expulsion from the University)

2. The Vice-Chancellor may impose one or more of the punishments listed in Section II, No. 01 (i) to (vii) above without holding any preliminary inquiry, and without obtaining the sanction of any other person, and so as to take immediate effect, if he has reason to believe that the action or behaviour of any student could lead to a breakdown of discipline of the University or render difficulty in the normal running of the University, or lead to a breach of the peace.

3. Any student dissatisfied by the imposition upon him of one or more of the punishments listed in section 11, No.01 (i) to (vii), may appeal against the punishments to the Vice Chancellor within 14 days of being notified of the same.

4. The decision of the Vice-Chancellor in consultation with the Council shall be final.

5. Apart from the imposition of the punishments listed in Section 11, No.01 (i) to (viii), if a student has been found guilty of any offence referred to in section 1, the University reserves for itself the right to review and re-evaluate the conduct of such a student during his/her period in the University, before conferring upon him/her any degree, diploma or certificate.

General Inquiries

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