SRI VENKATESWARA COLLEGE OF ENGINEERING

(An Autonomous Institution: Affiliated to Anna University, Chennai – 25)

MINUTES OF ACADEMIC COUNCIL MEETING

Ref.: AC MIN/2020-21/13   **Date: 05.05.2021**

Venue: Google Meet (Online)   **Time: 10.00 AM**

Members present:

01.	Dr.S. Ganesh Vaidyanathan, Principal/SVCE, Chairperson	12.	Dr.R.Kumutha, HoD/CVE, Member
02.	Dr.P. Thamarai, Principal GCT, Coimbatore, AU Nominee	13.	Dr.R.Anitha, HoD/CSE, Member
03.	Dr.M. Vijayaraj Prof. & Head/ECE/GCE Tirunelveli AU Nominee	14.	Dr.K.R.Shantha, HoD/EEE, Member
		15.	Dr.S.Muthukumar, HoD/ECE, Member
04.	Dr. R. Boopathi Rani Asso.Dean(Academics), NIT- Puducherry - AU Nominee	16.	Dr.V.Vidhya, HoD/INT, Member
		17.	Prof. S.Krishnan, HoD/MAR, Member
05.	Mr.S. Ravichandran Senior VP & plant head, plant –III, Oragadam, Delphi-TVS Diesel, Industrial Expert Member	18.	Dr.S.RameshBabu, HoD/MEC, Member
		19.	Dr. A. Bhaskar, HoD/APH, Member
06.	Mr. Ganesh Kalyanaraman Senior Vice President - Products and Resources at Cognizant Industrial Expert Member	20.	Dr.T.Murugavel, HoD/HSS, Member
		21.	Dr.NalinkanthV.Ghone, Professor/ Chemical, Member
07.	Mr. K. Shankar Director,INDCZECH ENGINEERING PRIVATE LIMITED, Industrial Expert Member	22.	Dr.C.Gopinath, Associate Professor/EEE, Member
		23.	Mr. V.Gurusamy, Assistant Professor/Marine, Member
08.	Dr.N.Kumaravel, Professor of Eminence, Anna University, Subject Expert Member	24.	Dr.M.PremAnanth, DCoE/SVCE, Recording Member
09.	Dr.J.Venkatesan, HoD/AUT, Member	25.	Dr.M. Sivanandham, Secretary/SVEHT, Permanent Invitee
10.	Dr.N.Meyyappan, HoD/CHE, Member	26	Dr.K.Pitchandi, CoE/SVCE MemberSecretary
11.	Dr.V.Sumitha, HoD/BIO, Member		

13.1 WELCOME NOTE AND CHAIRPERSON ADDRESS

The 13th academic council meeting was conducted in an online mode using Google Meet platform. The Chairperson welcomed all the members in general and the Anna university nominees and industrial experts in particular and initiated the proceedings. He thanked all invitees for their presence at the meeting. He said it is the second

meeting with the newly appointed Anna university nominees. Chairman placed on record, his sense of gratitude to the previous members of the Academic Council, members of respective Boards of Studies and Members of Result Passing Board for their support in conducting the meetings during the last four years.

As a recap, Prof. Ganesh Vaidyanathan mentioned that SVCE had been conferred autonomous status from 2016 onwards and there are two Regulations, one is Regulation 16, introduced from the academic year 2016-2017 and it is for those students who admitted during 2016-17 and 2017 - 18, and another one Regulation 18 introduced from the academic year 2018-2019 for those students who were admitted during 2018-19, 2019-20 and 2020-21.

He told the council that curriculum introduced in 2018 follows the CBCS system of curriculum and thanked members of Boards of Studies in preparing curriculum and syllabus. He informed to the members that we are having a plan to introduce new regulation in 2022 by taking into consideration of changes that is happening in the teaching learning process. He also told the members that the Regulation 22 would have more industrial collaboration in the framing of curriculum and syllabus and in the teaching learning process. He also informed that first batch of 2016-20 UG students graduated and requested CoE to present the data during his presentation.

Chairperson sought an approval of the minutes of 12[th]Academic council meeting held on 14.12.2020 and asked the members to give their approval in chat box. All the members accepted the minutes and approved the same. He requested Prof. Dr. M. Sivanandham the special invitee to address the council.

13.2 BRIEFING BY MEMBER-SPECIAL INVITEE

The Special Invitee, Prof. Dr. M. Sivanandham welcomed all members, particularly, the nominees from Anna University and industrial expert members. He appreciated all the members of the faculty, starting from the person involved in the development of curriculum and syllabus to those who involved in conducting the assessments for grading the students for successful graduation.

He also conveyed to the council about the graduation of first batch of UG students in the month of May 2020 and said it is an important milestone of SVCE and appreciated the efforts of all members who were instrumental in this process. He also mentioned that the arrear examinations for the 2016-2020 UG batch students were not conducted during the May 2020 session, instead, it was conducted during the December 2020 session. He also asked to provide the pass percentage and degree awarded details of the whole 2016-2020 batch students after the declaration of the arrear results to the members of the council.

13.3 DISCUSSIONS ON AGENDA

Chairman, requested the Member Secretary to initiate the discussion in respect of the agenda of the meeting.

13.3.1 Agenda 1. Requesting the approval of Previous minutes of the meeting

Chairperson and member secretary sought an approval of the minutes of 12th Academic council meeting held on 14.12.2020 and asked the members to give their approval in chat box. All the members accepted the minutes and approved the same.

13.3.2 Agenda 2. Introduction of new regulation R-22 for both UG and PG programme

Member secretary informed the members about the necessity for introducing the new regulation R22 in SVCE for both UG and PG programmes. He also mentioned that two major areas such as manufacturing and renewable source of energy are going to be main focus in developing the curriculum and syllabus in the upcoming regulation. Chairperson added that new curriculum would also focus towards the catering the needs of the industries and also will include the emerging topics such as Artificial Intelligence and Cyber Security.

Chairman said to the council that the new regulation R22 would be developed with the inputs from the industrial experts to reduce the gap between the expectations of the industry and outcome of the Institution. He invited suggestions from the members on designing new curriculum.

Dr.J.Venkatesan, HoD/AUT informed that as per members of BoS view, more focus to be given in the syllabus towards mathematical modeling of the topics in their courses to promote the placement opportunity of the students. He also mentioned to the members that their BoS members wanted to have specific topics with respect to the branches in Basic Science Courses (Mathematics, Physics and Chemistry) or else separate basic science courses to each and every Engineering programmes.

He also said that his members insisted that the curriculum and syllabus to be vetted by the industrial experts and also to refer the AICTE model curriculum while framing the syllabus. His members also suggested to remove the obsolete topics with the consultation of industrial experts. Mr. Ganesh Kalyanaraman opined that in present scenario manufacturing process are digitised and asked to frame the syllabus towards this aspect.

Prof. N. Kumaravel suggested to fix the percentage of new courses to be included in the curriculum of each and every engineering programmes by keeping the availability of either internal or external expert members to teach those new courses. He also cautioned that the expert to teach the subject need to be readily available. Prof. P. Thamarai agreed with the above and said they had faced difficulty in finding faculty and industrial experts to teach some of the courses introduced in their new curriculum. Chairman replied that the above said point would be kept while designing the curriculum. He further added that the Management is taking every steps to impart the latest industrial concepts to our faculty members.

Dr. M. Sivanandham, Secretary suggested to frame the syllabus to cater the needs of the industry and also suggested to devise the ways and means to use digital platform to facilitate the experts from anywhere in the globe to offer the knowledge in new trends and technologies to our students. He also suggested to get the help from the industrial experts to teach certain topics to impart practical knowledge to the students.

Prof. S. Krishnan HoD -MAR informed that the BoS members suggested to include thrust areas such as alternative fuels for Marine engines particularly Ammonia and methods to control Carbon emission control from the marine engines. He further

informed the council that BoS members wanted to include Anti fouling paints for ships with the aim to improve the fuel efficiency and to protect the marine environment. The BoS members also suggested to include in the syllabus the use of Artificial intelligence during the manufacturing processes of marine machinery components.

Mr.S. Ravichandran informed that it would be certainly difficult to have outside experts to teach one full course. At the same time the faculty members may not have the expertise in the current topics especially digitalization of various industrial process. For which, he suggested to train the faculty in suitable industries on high end technology for more duration to have that knowledge to teach the new courses.

Mr. K. Shankar said to look the opportunity to get the help from Technip India limited for training our faculty members in the field of offshore technology, since they are using the cutting edge technology in the offshore engineering. He also assured to help us in this regard to get our faculty members trained in the Technip India limited. He also made a point to focus on hydrogen as an alternate fuel. Further he suggested to have collaboration with industries where the full-fledged training centres are available. This will help the students to gain more practical knowledge.

Prof.S.Krishnan, HoD/MAR replied that since the hydrogen is highly explosive in nature, green ammonia is being used in the marine engines and planning to include this technology in the upcoming curriculum. Dr.N.Meyyappan, HoD/CHE expressed his willingness and asked Mr.K.Shankar to arrange training for some faculties of his department to learn the offshore technology. Mr.K.Shankar agreed upon the request of HoD/CHE. Dr.P. Thamarai suggested to design the new curriculum in line with AICTE model curriculum and also suggested to include the assessment norms to the newly developed industrial subjects in the regulations. She further insisted to include E-Vehicle policy in the curriculum of all engineering programs in the new Regulation.

Dr.S.Muthukumar, HoD/ECE informed that based on their BoS members suggestion they are planning to move some professional elective subjects to professional core. He also informed that the trends such as MEMS, Nano Devices, Cyber security, wireless

technology, IOT, Radar signal processing, surface mounting technology and block chain technology will be included in their new curriculum.

Dr.R.Anitha, HoD/CSE informed that they planned to emphasize on analytics and modelling and also provide industrial perception in their curriculum. She also told that their BoS members insisted to make it mandatory for the faculty members to have the industrial training. Principal also vouched the above points and told further to include value added or certificate courses in the industrial specific courses, if not a dedicated course for the same.

Dr. M. Sivanandham, Secretary suggested to include the novel subjects to enhance the value of Engineering degree. In this aspect he suggested to have one subject called "understanding of biological principles" in new curriculum since most of the engineering equipments are used by human and they should understand the inpact of various equipments and machineries on the living beings. He also conveyed to the council that he had suggested Dr. A. Bhaskar, HoD/APH to take the initiative to introduce this subject. Dr. A. Bhaskar, HoD/APH replied that it was already initiated and got the approval from their BoS meeting held on 16/04/2021.

Prof. Baskaran also mentioned that their BoS members approved the syllabus for the mathematics subject for M.Tech Cyber forensics and Information security. He further told the council that they also approved the certificate course on Quantum principles. He also mentioned that a new course would be introduced as open elective and will be optional to the students in the name of Role of Tamil language in Technology and requested the council for its approval. which will be introduced.

Member Secretary sought an approval for framing regulation and curriculum under R-22 and it was unanimously accepted by all the members of the board.

13.3.3 Agenda 3. 2020-21 even semester teaching learning process and continuous assessment

Member secretary informed that as per AU guidelines, the classes have been handled through online for the 2020-21 even semester and assessment also carried out through online platform "Google Class room".

13.3.4 Agenda 4. Modalities for end semester examinations for even semester 2020-21 academic year

The member secretary informed the council about the modalities going to be followed at SVCE for conducting the end semester examinations for 2020-2021 even semester.

He also explained that the modalities are going to be the same as that of Odd Semester of 2020-2021. He explained that the end semester examinations are going to be conducted as "online proctored examinations". The End semester examinations are going to be conducted as an Open Book Examination". Since the Examinations are open book type, the faculty members are instructed to set the question papers at the RBT level of 3 and above. He requested chairmen of various boards to ensure the above by conducting the thorough scrutinizing along with external expert members.

To maintain the sanctity of the examination system, it is decided to modify the question paper pattern and also to introduce shuffled question papers for a particular subject.

New Question Paper Pattern

Part I – There are 10 questions with 2 marks each - 10 X 2 = 20 Marks

Part II – There are 5 questions with 12 marks each - 5 X 12 = 60/80 Marks

All the questions should be set at the RBT Level of 3 and above.

➢ In Part I, there are Five subdivisions namely A, B, C, D and E. The question paper setter should prepare 5 questions in each of the subdivisions, i.e., the question paper setter should prepare 25 questions of 2 mark each.

➢ The 5 questions in each subdivision should be from the same unit of that subject. All the questions in a subdivision should be at same RBT and for the same CO.

- ➢ All the questions in the subdivision A should be of MCQ type.
- ➢ There is no link between subdivisions and UNIT of the subject, i.e., any subdivision may be linked with any one of the 5 units. However, all the questions in a subdivision should be from the same unit.
- ❖ In Part II, there are Five subdivisions namely F, G, H, I and J. The question paper setter should prepare 5 questions in each of the subdivisions, i.e., the question paper setter should prepare 25 questions of 12 mark each.
- ❖ Each 12-mark question should be set as a single 12 mark questions or two 6 mark questions. There should not be any other split up for these questions.
- ❖ The 5 questions in each subdivision should be from the same unit of that subject. All the questions in a subdivision should be at same RBT and for the same CO.
- ❖ There is no link between subdivisions and UNIT of the subject, i.e., any subdivision may be linked with any one of the 5 units. However, all the questions in a subdivision should be from the same unit.

Overall, a question paper setter is required to prepare 25 – 2 mark questions and 25 - 12 mark questions for a subject. A software will be provided to key in all the 50 questions along with the key.

He also told the council that the students are going to be instructed to pre-register for their examinations. This will help us to find the group of students who are going to write the exams in nearby areas. The software will distribute the question papers with more uniqueness to those students. He also informed that as students begin to write exam, his/her mobile phone would be monitored continuously to check whether the student is involving any sort of malpractice.

Dr.M.Vijaraj enquired about the question paper pattern and the member secretary replied that the examinations are going to be conducted for 3 hours. However, the maximum mark for the examinations is 80. The question papers are going to be set in such a way that it covers all the 5 units of syllabus. He also explained that this reduction of maximum mark would help the students to complete the examinations in the new methodology of writing the examinations. He explained the question paper pattern to the council, as it is mentioned above.

Chairman told Dr.M.Vijaraj that this descriptive examinations would improve the skill of students in explaining the engineering concepts with neat diagram Dr.M.Vijaraj suggested to increase the number of 2 mark questions for the end semester examinations since it is open book type, and the chairperson replied that will try to accommodate his valuable suggestion.

13.3.5 Agenda 5. Conduction of practical classes and its end semester examination

Member Secretary informed that first semester practical classes of I year UG and PG students will be conducted at the end of the semester as offline mode. Similarly, even semester practical classes of all the students of UG and PG and its examinations will be conducted as offline mode.

Dr. M. Sivanandham, Secretary suggested to compare online exam results with the historical offline exam pass percentage. He also said to analyze the pass percentage and to seek the possibilities to implement the relative grading for the online examinations. Chairperson replied that as we do not have the provision for relative grading in R-16 and 18, it will be considered in R-22.

Dr.P. Thamarai suggested to follow absolute grading as AU framed the similar rule for its affiliated institutions. Dr. R. Boopathi Rani informed that they are following the relative grading in their institution. Member secretary informed the council that he would study and discuss the same with staff council members for proposing as a circular resolution to the council. Dr. M. Sivanandham, Secretary suggested to study on this idea and asked to propose the circular resolutions.

Dr. R. Boopathi Rani suggested to include viva component in the end semester examination. Chairperson welcomed the above suggestion as it is an important component to validate the understanding of subject. He also said that the viva voce component being practiced in practical subject and assured to look into the feasibility of it in theory subjects. Dr.N.Kumaravel opined to include the viva voce component in continuous assessment instead of end semester exams and the same is accepted by all the members.

Dr.N.Kumaravel enquired about why the end semester exams are conducted for 80 marks in 3 hours. CoE replied that the number questions are reduced to enable the students to scan and upload the answer papers in examination app provided.

13.3.6 Agenda 6. Certain clarification on Regulation-18

CoE proposed the following for the approval of council

1. Passed out students can redo the practical courses, if they have any arrear in the practical courses, in all semesters instead of when it is offered as a regular course.
2. Withdraw of the practical courses will be considered as reappearance and hence they have to appear only for end semester examination by retaining same internal mark earned.

Dr.N.Kumaravel enquired about whether redo will be applicable only for arrear students or it will be applicable for improvement also. CoE replied that redo is permitted only for the arrear students. Dr. R. Boopathi Rani suggested to conduct the redo practical classes during vacation as they used to follow this procedure in their institution. CoE accepted this suggestion and told that it would be implemented after consulting with the concerned department.

Dr. M. Sivanandham, Secretary enquired about internal external mark weightage for the practical course. CoE replied that 75:25 is the internal-external weightage for the practical. He also said that external passing minimum is fixed as 45% and Internal-External mark put together need to be 50%. Dr. M. Sivanandham, Secretary suggested to remove the end semester passing minimum for practical course as they studied almost 80% of the course during regular class. This practice would be helpful to the students who is unable to appear for the end semester exam due to valid reason and as they need not to redo the course later.

Dr.N.Kumaravel informed that since the students are performed practical courses as a group during continuous assessment and it is not possible to evaluate the individual

student performance. Hence, individual evaluation is only possible during end semester examination as they made to perform individually.

13.3.7 Agenda 7. Amendment in Regulation-18

CoE informed to the members of the board that a new clause is going to be introduced for facilitating the students to do the credit transfer in the regulation 2018 of both UG and PG. He further told that a maximum of 20% of total credit could be transferred by a student. He then added that it is going to be an optional to the students. Dr. M. Sivanandham, Secretary wanted to know whether a student would be permitted to do the course physically in other reputed institutions. CoE replied that this provision also could be given to the students if the council approve the same.

Dr.N.Kumaravel enquired about the assessment of students at SVCE who took the online course. CoE clarified that provision of studying online courses is also there in the curriculum which totally different from the credit transfer. CoE Further told that a student could study a maximum of 3 online courses and for which the students could replace only professional electives, whereas course studied under credit transfer would replace core, open elective and professional elective. He also presented data related to courses studied under SWAYAM during December-20 examinations. Council approved the proposal.

13.3.8 Agenda 8. M. Tech in Cyber Forensics and Information Security

CoE told the council that a new PG program M.Tech in Cyber forensics and Information Security would be introduced from the academic year 2021-2022 onwards. Dr.V.Vidhya, HoD/INT informed that they have drafted both curriculum and syllabus for the above course and the same was approved by Anna University. She also informed that with the support of Alumni, Industrial experts and eminent academicians from IIT and NIT, the curriculum and syllabus was framed and presented the curriculum in detail to the members.

Dr.P.Thamarai enquired about the eligibility for the course and HoD/INT replied that the students of ECE, EEE, CSE and IT are eligible and the same was communicated to Anna University. Mr.S. Ravichandran enquired about faculty availability to teach this course and HoD/INT replied that 4 faculty of IT department available with the cyber security background.

Dr. M. Sivanandham, Secretary enquired about any attempt made to sign MoU with industries for sponsoring their employees to undergo the above program in SVCE. HoD/INT replied that they have approached some industries and the process in pipeline for sponsoring their employees to study the above program.

13.3.9 Agenda 9. Reduction in intake of certain U.G / P.G. courses (2021-2022)

CoE informed that as per the provisions in AICTE Handbook 2021-22 under the "Requirements and Eligibility" (2.18.1), it is proposed to reduce the student intake of certain undergraduate courses (B.E- Automobile Engineering, B.Tech- Chemical Engineering, B.E- Civil Engineering and B.E- Marine Engineering) and Postgraduate courses (M.E-Communication systems, M.E-Computer Science and Engineering, M.Tech-Computer Science and Engineering (Networks), M.E.-Mechatronics and M.E. Power Electronics and Drives) is as follows.

S.No	Courses	Existing Intake	New Intake
UG			
1	B.E. Automobile Engineering	60	30
2	B.Tech. Chemical Engineering	120	90
3	B.E. Civil Engineering	60	30
4	B.E. Marine Engineering	60	30
PG			
5	M.E. Communication Systems	25	12
6	M.E. Computer Science and Engineering	25	12
7	M.E Computer Science and Engineering (Networks)	18	12
8	M.E. Mechatronics	18	12
9	M.E. Power Electronics and Drives	25	12

CoE asked the chairman to elaborate on this point. Chairman explained various ground realities to go for this intake reduction. Chairman also informed the council that this is proposed to maintain good track record of percentage of seat filled up in every year which will be helpful for obtaining good ranking in NAAC and also for NBA purposes.

He also said that this proposal is already approved by members of BOT and Governing Council. Prof. Thamarai wanted to know the intake for new PG program M. Tech in Cyber forensics and Information Security for which HoD/INT replied that it is 18. Mr. K. Shankar asked why there is a reduction in Civil Engineering course as the infrastructure sector is coming up in big ways. Chairperson replied that students especially from government allotment are not willing to take civil engineering and assured him that we would revoke to original intake once the situation improves. Prof. Kumaravel told that this move would help the civil engineering to get the NBA accreditation.

Dr. M. Sivanandham, Secretary informed to the council that AICTE themselves reduced the strength of M.Tech.-Chemical Engineering from 18 to 9 since the admission was poor continuously for past three years. Council approved the same.

13.3.10 Agenda 10 Approval of the recommendations of the various boards of studies presented by the respective Chairmen.

HoD/AUT, informed the council that the members approved the inclusion of one new course "Control system for Mechanical Engineering" for B.E – Mechanical Engineering under the professional elective category under the regulation 2018 in the odd/even semester. He further told that the list of courses offered as the certificate courses in the department of Automobile and Mechanical engineering. Further he wanted to have the approval for replacing the core subjects using the online courses. CoE replied that this would be put forth to the academic council after the discussion in our staff council meeting to get the input from all the heads of the departments.

HoD/CHE, informed about the points discussed in their BoS. He told that there is a change in the syllabus of CH18704- Process Equipment Design – II. He also told that the members had suggested to follow the AICTE model curriculum for designing the

new curriculums for the UG and PG programs under the Chemical and Biotechnology departments. He further told the council about the list of new certificate courses offered by the Chemical and Biotechnology departments.

HoD/CVE mentioned that they have introduced some new professional elective courses and open elective course in the curriculum of B.E. Civil engineering under the Regulation 2018. She further told the council that they had introduced 7 new value added courses in the curriculum and 3 new certificate courses for all the students. She also told the council that the draft curriculum had been discussed in their BoS and members gave good amount of input to improve the content of the new curriculum.

HoD/CSE briefed the council about their BoS meeting outcome. She told that the members approved the syllabus of the III and IV semester courses of B. Tech Artificial Intelligence and Data Science. She also told the members that the BoS members had given a lot of input for the identification of courses in the V, VI, VII and VIII semester for the curriculum of B. Tech Artificial Intelligence and Data Science. She also told that the BoS members had approved the different assessment pattern for the subject OE18804 in the End semester examinations as 60% Practical and 40% Theory components. She further told the council that a new professional elective Block chain for Business had been included in the curriculum of B.E., Computer science and Engineering and B. Tech Information Technology.

HoD/EEE told the council about the discussion they had in their BoS meeting held recently. She told the council that they have a lengthy discussion about the development of curriculum for B.E. Electrical and Electronics Engineering and B.E Electronics and communication Engineering under Regulation 2022. She also told that the members had given a lot of inputs for the development of the new curriculum and on teaching and learning process.

HoD - MAR informed about the points discussed in their BoS meeting. He told the council members that the BoS members were informed about the successful commencement of the mandatory training by the 21st batch of the students at Cochin Shipyard Limited (CSL) He further informed the council about the certificate

courses proposed to be offered by the department particularly in Welding and the application of Data analytics in the marine field with assistance from the CS department. He informed the council that On - Line courses for this program are not offered primarily due to non - availability of suitable courses.

HoD/APH told the council about the outcome of their BoS meeting. He told the council the members approved the syllabus of mathematical foundation for information security for M. Tech Cyber Forensics and Information security. He also mentioned that a new certificate course Basics of Quantum mechanics is going to be offered by the Applied Physics department. He further said that a new course named "Biology for Engineers" and its syllabi was approved by the members. This subject may be included in the curriculum of various UG Engineering programs under the regulation 2022.

13.3.11 Agenda 11 Any other point with the permission of the Chairmen.

Chairman asked CoE to presented the details of the students graduating from the autonomous stream of SVCE. CoE mentioned that there are 1055 students in 2016-20 UG batch. Out of the 1055 students 1029 got their degree which comes out to be 97.5 %. He further informed that 100% of the PG students got their degree from the 2016-2018, 2017-2019, 2018-2021 batches. Chairperson added to that for all the above students, college received the provisional degree from the Anna University.

13.4   Resolutions

13.4.1   Resolved to approve the minutes of the 12ᵗʰ Academic council meeting, held on 14.12.2020.

13.4.2   Resolved to approve, in principle to introduce the new regulation R2022 for those students who are going to be admitted from the academic year 2022-2023 for both UG and PG programs.

13.4.3   Resolved to approve the teaching learning process using Google class room during the even semester of 2020-2021.

13.4.4 Resolved top approve the assessment methodology in the Google Classroom for the continuous assessment.

13.4.5 Resolved to approve the following method for conducting the end semester examinations of 2020-2021 even semester based on the recommendations given by the Anna University, Chennai

I.   *The examinations will be conducted through online mode as online proctored examinations. Intermittent Automatic proctoring system will be used for the examinations.*

II. *It will be an "Open Book examinations" with appropriate level of standard to suit the same.*

III. *The examinations are descriptive in nature.*

IV. *The question paper is for a maximum of 80 marks and the time duration is three hours.*

V.   *All the questions in the question papers, are at the RBT level of 3 or above.*

VI. *The papers will be stored electronically and those papers will be corrected digitally.*

VII. *Students will be given shuffled question papers with different level of uniqueness.*

VIII.*Pre-registration for the examinations by the students is required to identify the cluster and checking for any impersonation.*

13.4.6 Resolved to approve to conduct the practical classes for IV and VI semester for II and third year UG students at the end of the academic year. It is also approved to conduct the practical classes for I and II semester for I year students at the end of the academic year.

13.4.7 Resolved to approve to include the following under the clause of 6.5.2 and 5.4.5 of regulations 2018 of UG and PG respectively.

<i>Passed out students can redo the practical courses, if they have any arrear in the practical courses, in all semesters instead of when it is offered as a regular course.</i>
<i>Withdraw of the practical courses will be considered as reappearance and hence they have to appear only for end semester examination by retaining same internal mark earned.</i>

13.4.8   *Resolved to approve to include new clause in both the UG and PG regulations of R18 to facilitate the students for credit transfer by satisfying the following requirements.*

<i>Maximum 20% credit can be transferred.</i>
<i>Only through SWAYAM if it is through online mode.</i>
<i>The same can be done in physical mode also in the reputed institutions during the summer and winter vacations</i>
<i>DCC should approve the equivalency of the subject and the institution for studying those subjects.</i>
<i>Credit transfer can be used for any courses except open electives.</i>

13.4.9   *Resolved to approve the curriculum and syllabus of M. Tech Cyber forensics and information security as given below.*

SRI VENKATESWARA COLLEGE OF ENGINEERING
(An Autonomous Institution, Affiliated to Anna University, Chennai)
SRIPERUMBUDUR TK. - 602 117
DEPARTMENT OF INFORMATION TECHNOLOGY
M.Tech Cyber Forensics and Information Security
CURRICULUM & SYLLABUS

SEMESTER I

Sl. No.	Course Code	Course Title	Category	Contact Period	L	T	P	C	Pre-Requisite	F/M
1		Mathematical Foundations For Information Security	FC	4	3	1	0	4	-	F
2		Foundations of	PC	4	3	1	0	4	-	F

		Cyber Security								
3		Advanced Operating Systems	PC	3	3	0	0	3	-	F
4		Network Principles and Security	PC	3	3	0	0	3	-	F
5		Computer Forensics and Digital Evidence	PC	3	3	0	0	3	-	F
6		Network Design and Security Laboratory	PC	3	0	0	3	2	-	F
7		Ethical Hacking Essentials Laboratory	PC	3	0	0	3	2	-	F
				23	15	2	6	21		

SEMESTER II

Sl. No.	Course Code	Course Title	Category	Contact Period	L	T	P	C	Pre-Requisite	F/M
1		Biometrics: Fundamentals to Security	PC	3	3	0	0	3	Foundations of Cyber Security	M
2		Digital Forensics and Digital Investigations	PC	4	3	1	0	4	-	M
3		Blockchain for Security	PC	3	3	0	0	3	-	F
4		Internet of Things and Security	PC	4	3	1	0	4	-	F
5		Professional Elective I	MC	3	3	0	0	3	-	F
6		IoT and Blockchain Laboratory	PC	3	0	0	3	2	-	F
7		Digital Forensics Laboratory	PC	3	0	0	3	2	-	F
8		Case Study I – Forensic Investigations	EEC	2	0	0	2	1	-	F
				25	15	2	8	22		

SEMESTER III

SL. No.	Course Code	Course Title	Category	Contact Period	L	T	P	C	Pre-Requisite	F/M
1		Penetration and Application Testing	PC	4	3	1	0	4	Network Principles and Security	F
2		Professional Elective III	PE	3	3	0	0	3	-	M
3		Professional Elective IV	PE	3	3	0	0	3	-	M
4		Professional Elective V	PE	3	3	0	0	3	-	M
5		Project Phase 1	EEC	12	0	0	12	6	-	F
				25	12	1	12	19		

SEMESTER IV

Sl. No.	Course Code	Course Title	Category	Contact Period	L	T	P	C	Pre-Requisite	F/M
1.		Project Phase 2	EEC	24	0	0	24	12	Project Phase I	F
				24	0	0	24	12		

Total Credits : 74

PROFESSIONAL ELECTIVES

Sl. No	Course Code	Course Title	Contact Period	L	T	P	C
1		Applied Cryptography	3	3	0	0	3
2		Machine Learning Techniques (Common to CP,NW&CFIS)	3	3	0	0	3
3		Data Mining Techniques	3	3	0	0	3
4		Intrusion Detection and Prevention Systems	3	3	0	0	3
5		Social Network Analysis (Common to NW & CFIS)	3	3	0	0	3
6		Principles of Secure Coding	3	3	0	0	3
7		Trust Management in E – Commerce	3	3	0	0	3
8		Biometric Image Processing	3	3	0	0	3
9		Cyber Security Management and Cyber Laws	3	3	0	0	3
10		Network Virtualization (Common to NW & CFIS)	3	3	0	0	3
11		Cloud Computing Technologies (Common to CP, NW & CFIS)	3	3	0	0	3
12		Energy Aware Computing	3	3	0	0	3
13		Advanced Infrastructure Management (Common to NW & CFIS)	3	3	0	0	3
14		Malware Analysis and Reverse Engineering	3	3	0	0	3
15		Data Analytics and Business Intelligence (Common to NW & CFIS)	3	3	0	0	3
16		Wireless Security	3	3	0	0	3

Total Credits (From Sem I to IV): 74

MATHEMATICAL FOUNDATIONS FOR INFORMATION SECURITY

L	T	P	C
3	1	0	4

Course Objectives:

The students will be able to

- To understand the concepts of number theory which play an important role in computer science and cryptography
- To understand basic concepts of various algebraic structures used in computer science
- To understand the concepts of advanced algebraic structures used in computer science
- To understand the basic mathematical principles and functions that form the foundation for coding theory
- To understand basics of elliptic curves and pseudo random numbers and its usage

Unit I   Number Theory   12

Introduction - Divisibility - Greatest common divisor - Prime numbers - Fundamental theorem of arithmetic - Fermat numbers - Euclidean algorithm - Fermat's theorem - Euler totient function - Euler's theorem. Congruence - Definition - Basic properties of congruence - Residue classes - Chinese remainder theorem.

Unit II   Algebraic Structures I   12

Groups – Cyclic groups, Co sets, Modulo groups - Primitive roots - Rings – Sub rings, ideals and quotient rings.

Unit III   Algebraic Structures II   12

Integral domains, Fields – Finite fields - Classification - Structure of finite fields.

Unit IV   Coding Theory   12

Introduction - Basic concepts - Codes, minimum distance, equivalence of codes, Linear codes - Generator matrices and parity - Check matrices - Hamming codes.

Unit V   Elliptic Curves and Pseudorandom Number Generation   12

Discrete Logarithm - Elliptic curves - Introduction to Pseudo random numbers.

Total Hours:60(L:45+T:15)

Course Outcomes:

At the end of the course, the students will be able

- This course equips the students to have basic knowledge of the concepts of number theory and their applications to cryptography
- This course equips the students to have knowledge of the concepts of various algebraic structures used in computer science
- This course equips the students to have knowledge of the basic concepts of mathematical principles and functions that form the foundation for coding theory
- This course equips the students to have knowledge of the basic concepts of discrete logarithms, elliptic curves and pseudo random numbers.

Text Books:
1. Kenneth H Rossen, Discrete Mathematics and its Applications, Seventh Edition, McGraw Hill, 2012.
2. Rudolf Lidl, Gunter Pilz, Applied Abstract Algebra, Second Edition, Springer, 1998.
3. D.S. Malik, J. Mordeson, M.K. Sen, Fundamentals of abstract algebra, McGraw Hill, 1997.
4. Joseph A. Gallian, Contemporary Abstract Algebra, Narosa, 1998.
5. L. Washington, Elliptic Curves: Number Theory and Cryptography, Chapman & Hall CRC, 2003.

References:

1. Niven, H.S. Zuckerman, H. L. Montgomery, An introduction to the theory of numbers, John Wiley and Sons, 2001.
2. Fraleigh J.B., A first course in abstract algebra, Pearson Education, 2005.
3. Douglas R Stinson, Cryptography: Theory and Practice, CRC Press, 2015.

FOUNDATIONS OF CYBER SECURITY	L	T	P	C
	3	1	0	4

Course Objectives:

The students will be able to

- Understand various block cipher and stream cipher models
- Describe the principles of public key cryptosystems, hash functions and digital signature
- To get a firm knowledge on Cyber Security Essentials

Unit I   Introduction to Security   12

Data Encryption Standard-Block cipher principles-block cipher modes of operation-Advanced Encryption Standard (AES)-Triple DES-Blowfish-RC5 algorithm

Unit II   Public Key Cryptography and Hash Algorithms   12

Principles of public key cryptosystems-The RSA Algorithm-Key management - Diffie Hellman Key exchange- Hash Functions-Hash Algorithms (MD5, Secure Hash Algorithm)

Unit III   Fundamentals of Cyber Security   12

How Hackers Cover Their Tracks- Fraud Techniques- Threat Infrastructure- Techniques to Gain a Foothold (Shellcode, SQL Injection, Malicious PDF Files)- Misdirection, Reconnaissance, and Disruption Methods

Unit IV   Planning for Cyber Security   12

Privacy Concepts -Privacy Principles and Policies -Authentication and Privacy - Data Mining - Privacy on the Web - Email Security - Privacy Impacts of Emerging Technologies

Unit V   Cyber Security Management   12

Security Planning - Business Continuity Planning - Handling Incidents - Risk Analysis - Dealing with Disaster – Legal Issues – Protecting programs and Data – Information and the law – Rights of Employees and Employers - Emerging Technologies - The Internet of Things - Cyber Warfare

Total Hours:60(L:45+T:15)

Course Outcomes:

At the end of the course, the students will be able to,

- Implement basic security algorithms required by any computing system
- Analyze the vulnerabilities in any computing system and hence be able to design a security solution
- Analyze the possible security attacks in complex real time systems and their effective countermeasures
- Differentiate various governing bodies of cyber laws
- Impart various privacy policies for an organization

References

1. William Stallings, "Cryptography and Network Security", Pearson Education, 6th Edition, 2013.
2. Charles P. Pfleeger Shari Lawrence Pfleeger Jonathan Margulies, Security in Computing, 5th Edition , Pearson Education , 2015.
3. Graham, J. Howard, R., Olson, R., Cyber Security Essentials, CRC Press, 2011.
4. George K.Kostopoulous, Cyber Space and Cyber Security, CRC Press, 2013.

ADVANCED OPERATING SYSTEMS	**L**	**T**	**P**	**C**
	3	**0**	**0**	**3**

Course Objectives:

The students will be able to

- Have a detailed knowledge on Operating system concepts
- Understand the need for operating system security
- Administer an open source Operating System

Unit I   Operating Systems: Overview   9

Operating System structure and operations - Process Management- Memory Management – Storage Management - Protection and Security– Process Scheduling – Inter process communication- Multi threading models- Semaphores – Monitors - Deadlocks- Mutexes-Critical Section problem

Unit II   Memory Management in Operating System   9

Swapping – Contiguous Memory Allocation – Segmentation – Paging – Virtual Memory: Demand Paging – Page Replacement – Allocation of Frames – Thrashing – Allocating Kernel Memories

Unit III   Linux System Administration   9

Requirements for a Linux Administrator – Server Requirements – Logging in Remotely – Network configuration – Providing DNS – Adding Relational DB – Configuring mail securely – Adding FTP services – Synchronizing the system clock – Installing perl modules

Unit IV   Operating Systems: Trust Model   9

Security Goals – Trust and Threat Model – Protection System – Reference Monitor – Secure Operating System – Assessment Criteria – Mutics History – Multics System and Security

Unit V   Operating Systems Security   9

System History – Unix and Windows History – Unix Security – Windows Security – Verifiable Security Goals – Security Kernels – Securing Commercial Operating Systems

Total Hours:45

Course Outcomes:

At the end of the course, the students will be able to,

- Understand the basic functionalities of operating system
- Have a hands on experience in administration of Linux system
- Secure an operating system
- Perform memory management in OS

References

1. Abraham Silberschatz, Peter Baer Galvin and Greg Gagne, "Operating System Concepts", John Wiley & Sons ,Inc., 9th Edition, 2012.
2. Trent Jaeger, "Operating Systems Security", Morgan & Claypool Publishers, 2008.
3. Tom Adelstein and Bill Lubanovic, "Linux System Administration", O'Reilly Media, Inc., 1st Edition, 2007.
4. William Stallings, "Operating System: Internals and Design Principles", Prentice Hall, 7th Edition, 2012.

NETWORK PRINCIPLES AND SECURITY	**L**	**T**	**P**	**C**
	3	**0**	**0**	**3**

Course Objectives:

The students will be able to

- Identify the basic networking principles
- Understand the need for network security
- Expose themselves to security at various network layers

Unit I   Fundamentals of Networks   9

Networking Technology – Connecting Devices - The OSI Model - TCP/IP Model - Threats to

Network communications - Wireless Network Security – Denial of Service – Distributed Denial of Service

Unit II   Cryptography in Network Security   9
Malicious vs Non Malicious code – Counter Measures – Authentication – Access Control – Network and Browser Encryption – Firewalls – IDS – Network Management

Unit III   Network and Transport Layer Security   9
Network Layer: IPSec Protocol – IP Authentication Header – IP ESP – VPN - Key Management Protocol for IPSec – Transport Layer: SSL Protocol – TLS Protocol

Unit IV   E – mail and Web Security   9
Pretty Good Privacy – MIME – S/MIME - Enhanced Security Services for S/MIME - SET for E-commerce Transactions

Unit V   Cloud and Wireless Network Security   9
Cloud Computing – Cloud Security Risks and Counter Measures – Cloud Security as a Service – Wireless Network Security: Wireless Security – Mobile Device Security – WLAN Security

Total Hours:45

Course Outcomes:
At the end of the course, the students will be able to,
- Classify and secure various layers of networks
- Understand the concept of Network Layer Security
- Develop protocols for Web and Mail security
- Apply various password management techniques for system security
- Develop measures for cloud and wireless network security

References

1. Man Young Rhee, "Internet Security: Cryptographic Principles", "Algorithms and Protocols", Wiley Publications, 2003.
2. Charles Pfleeger, "Security in Computing", Prentice Hall, 4th Edition, 2006.

3. William Stallings, "Cryptography and Network Security", Pearson Education, 6th Edition, 2013.
4. Charlie Kaufman, Radia Perlman, Mike Speciner, "Network Security", Prentice Hall, 2nd edition, 2002.

COMPUTER FORENSICS & DIGITAL EVIDENCE

	L	T	P	C
	3	0	0	3

Course Objectives:

The students will be able to

- Study the procedure for forensic investigation
- Audit and analyse the computer systems for data extraction
- Understand the process of cloud and mobile device forensics

Unit I   Computer Forensics Fundamentals   9

Introduction to Computer Forensics – Computer Forensics Services – Benefits of Professional Forensics Methodology – Steps taken by Computer Forensics Specialists – Types of Computer Forensics System: IDS, Firewall – PKI – Wireless Network Security – Identity Management Security System – Identity Theft.

Unit II   Computer Forensics Technology   9

Types of Military, Business and Law Enforcement Computer Forensic Technology – Specialized Forensics Techniques – Hidden Data and How to Find it – Spyware and Adware – Encryption Methods – Internet Tracing Methods – Avoiding Pitfalls with Firewall – Biometric Security Systems.

Unit III   Data Acquisition and Processing Crime Scenes   12

Understanding Storage Formats for Digital Evidence - Determining the Best Acquisition Method - Using Acquisition Tools - Validating Data Acquisitions - Performing RAID Data Acquisitions - Identifying Digital Evidence - Collecting Evidence in Private-Sector Incident Scenes - Processing Law Enforcement Crime Scenes - Preparing for a Search - Securing a Computer Incident or Crime Scene - Seizing Digital Evidence at the Scene - Obtaining a Digital Hash.

Unit IV   Network and E – mail Forensics   9

Performing Live Acquisitions - Network Forensics Overview - Exploring the Role of E-mail in Investigations - Exploring the Roles of the Client and Server in E-mail - Investigating E-mail Crimes and Violations - Understanding E-mail Servers - Using Specialized E-mail Forensics Tools.

Unit V   Cloud and Mobile Device Forensics   6

An Overview of Cloud Computing - Legal Challenges in Cloud Forensics - Technical Challenges in Cloud Forensics - Acquisitions in the Cloud - Tools for Cloud Forensics - Understanding Mobile Device Forensics - Understanding Acquisition Procedures for Mobile Devices.

Total Hours:45

Course Outcomes:

At the end of the course, the students will be able to,

- Plan and prepare for all stages of an investigation
- Explore web server attacks, DNS and router attacks
- Examine network traffic and identify illicit servers
- Acquire data from mobile devices and crime scenes securely

References

1. Bill Nelson, Amelia Phillips, Christopher Steuart, "Guide to Computer Forensics and Investigations: Processing Digital Evidence", 5th edition, Cengage Learning, 2015.
2. John R.Vacca, "Computer Forensics", Cengage Learning, 2005.
3. Nelson, Phillips, Enfinger, Steuart, "Computer Forensics and Investigations", Cengage Learning, India Edition, 2008.
4. Marjie T.Britz, "Computer Forensics and Cyber Crime: An Introduction", 3rd Edition, Prentice Hall, 2013.

NETWORK DESIGN AND SECURITY LABORATORY	L	T	P	C
	0	0	3	2

Course Objectives:

The students will be able to
- Understand the basics of Networking
- Learn network programming in Linux using C/Python

List of Exercises

I   Network Design using CISCO Packet Tracer
1. Configure a LAN with a switch/hub with minimum 3 PCs
2. Configure a internetwork with 2 routers and two or more LANs using static routes
3. Establish a dynamic routing based internetwork with 2 routers and two or more LANs using RIP/OSPF
4. Analyze the performance of various TCP variants using an FTP application for the given network

II Network Programming using C/Python
5. Develop a program for demonstrating inter process communication
6. Creation of TCP client/server application
7. Creation of UDP client/server application
8. Develop an Iterative UDP server with 2 or 3 clients
9. Develop a concurrent TCP server with 2 or 3 clients
10. Implement Digital Signature
11. Implement ARP and RARP
12. Create a Socket based application in Python
13. Intrusion Detection using Snort tool
14. Create an application that interacts with e-mail servers in python
15. Develop applications that work with remote servers using SSH, FTP etc in Python
16. Simulate PING and TRACEROUTE commands

Total Hours:45

Course Outcomes:

At the end of the course, the students will be able to,

- Design and Configure LAN's
- Create simple network applications using C/Python

LIST OF EQUIPMENT FOR A BATCH OF 18 STUDENTS:
SOFTWARE:
Windows/Ubuntu/ Kali Linux with C/C++/Java/Python
Cisco Packet Tracer, Snort IDS, Eclipse or equivalent IDE
HARDWARE:
Standalone desktops - 18

	Total Hours: 45			
ETHICAL HACKING ESSENTIALS LABORATORY	**L**	**T**	**P**	**C**
	0	**0**	**3**	**2**

Course Objectives:

The students will be able to

- Understand the basics of Ethical Hacking
- Learn various Hacking tools

List of Exercise
1. Basic Linux Commands
2. Advanced Linux commands
3. Information Gathering
4. Vulnerability Analysis
5. Web Application Analysis
6. Database Assessment
7. Password Attacks
8. Wireless Attacks
9. Reverse Engineering
10. Exploitation tools
11. Sniffing & spoofing
12. VM-WARE

Total Hours:45

Course Outcomes:

At the end of the course, the students will be able to,

- Gather the information from various sources
- Assess the vulnerabilities in Database and Web application
- Learn various attacks and its counter measures

LIST OF EQUIPMENT FOR A BATCH OF 18 STUDENTS:
SOFTWARE:
Kali Linux and its Tools

HARDWARE:
Standalone desktops - 18

	Total Hours: 45			
BIOMETRICS: FUNDAMENTALS TO SECURITY	**L**	**T**	**P**	**C**
	3	**0**	**0**	**3**

Course Objectives:
The students will be able to
- Understand the functionalities of biometrics
- Discover the need of biometrics for an organization
- Learn to develop biometric based applications
- Emphasize the need of biometric security

Unit I   Fundamentals of Biometrics   9
Biometric System – Enrollment and recognition – Sensor modules – Feature extraction module - Database module – Matching module – Biometric functionalities – Biometric system errors – Design cycle of Biometrics – Security and Privacy issues.

Unit II   Fingerprint Recognition   9
Friction ridge pattern: Features and formation – Fingerprint Acquisition – Feature extraction – Matching – Fingerprint indexing – Fingerprint synthesis: Level 1 and Level 2 – Palmprint.

Unit III   Face and Iris Recognition   9
Psychology of face recognition – Facial features – Design – Image acquisition – Face detection – Feature extraction and matching – Face modelling – Iris Recognition: Design and Image acquisition – Image segmentation – Image normalization, Encoding and matching – Iris quality – Performance Evaluation.

Unit IV   Signature and Keystroke Recognition   9
Behavioural biometrics – Features and Classification – Signature Recognition: History of Handwriting Analysis - Automated Systems for Signature Recognition - Offline and Online Signatures - Types of Forgeries - Databases for Signature System Evaluation - Commercial Software – Signature Recognizers – Keystroke Dynamics: Keystroke Analysis - Authentication and Identification - Characteristics of Keystroke Dynamics - Approaches to Keystroke Dynamics.

Unit V   Security in Biometrics   9
Adversary Attacks – Insider and Infrastructure attack - Attacks at the User Interface –

Impersonation – obfuscation – spoofing - Countermeasure: spoof detection - Attacks on Biometric Processing – System modules and interconnections - Attacks on the Template Database - Biometric template security.

Total Hours:45

Course Outcomes:

At the end of the course, the students will be able to,

- Identify various biometric techniques
- Design biometric recognition systems
- Develop simple biometric based application
- Elucidate the need for biometric security

References

1. James wayman,Anil k.Jain ,Arun A.Ross ,Karthik Nandakumar, "Introduction to Biometrics", Springer, 2011.
2. Khalid saeed with Marcin Adamski, "New Directions in Behavioral Biometrics", CRC Press 2017
3. Paul Reid "Biometrics For Network Security ", Person Education 2004.

DIGITAL FORENSICS AND DIGITAL INVESTIGATIONS	L	T	P	C
	3	0	0	3

Unit I   Digital Forensics   9

Foundations of Digital Forensics - Digital Evidence - Increasing Awareness of Digital Evidence - Digital Forensics: Past, Present, and Future - Principles and Challenges of Digital Forensics - Digital Forensics Research - Language of Computer Crime Investigation.

Unit II   Digital Investigations   9

Conducting Digital Investigations - Digital Investigation Process Models - Scaffolding for Digital Investigations - Applying the Scientific Method in Digital Investigations - Fundamental Principles - Preparing to Handle Digital Crime Scenes – Surveying and Preserving the Digital Crime Scene - Equivocal Forensic Analysis – Victimology - Crime Scene Characteristics.

Unit III   Digital Evidence   9

Violent Crime and Digital Evidence - Digital Evidence as Alibi - Investigating an Alibi – Time and Location as Alibi - Investigating Computer Intrusions - Forensic Preservation of Volatile Data - Investigation of Malicious Computer Programs – Cyberstalking.

Unit IV   Computer basics for Digital Investigators   9

Basic Operation of Computers - Representation of Data - File Systems and Location of Data - Dealing with Password Protection and Encryption - Applying Forensic Science to Computers - Digital Evidence on Windows Systems - Digital Evidence on UNIX Systems.

Unit V   Forensic Science on Networks   9

Digital Evidence on the Internet - Online Anonymity and Self-Protection - E-mail Forgery and Tracking - Usenet Forgery and Tracking - Digital Evidence on Physical and Data-Link Layers - Digital Evidence at the Network and Transport Layers.

Total Hours:45

References

1. Eoghan Casey, "Digital Evidence and Computer Crime Forensic Science, Computers and the Internet", Third Edition, Elsevier, 2011
2. Kevin Mandia, Chris Prosise, Matt Pepe, ―Incident Response and Computer Forensics ―, TataMcGraw -Hill, New Delhi, 2006.
3. Nelson Phillips and Enfinger Steuart, ―Computer Forensics and Investigations‖, Cengage Learning, New Delhi, 2009.
4. Cory Altheide and Harlan Carvey, ―Digital Forensics with Open Source Tools‖ Elsevier publication, April 2011

BLOCKCHAIN FOR SECURITY	**L**	**T**	**P**	**C**
	3	**0**	**0**	**3**

Course Objectives:

The students will be able to

- Understand the cryptography basics of a blockchain
- Recognize the requirement of a simple blockchain application
- Study about the tools used for blockchain development

Unit I   Crypto Fundamentals for Blockchain   12

Hash Functions – Digital Hash – Pre-image resistance – Second pre-image resistance – Message Digest – Secure Hash Algorithms – Distributed Hash Tables – Digital Signatures – Signcryption – Blind Signatures.

Unit II   Features of Blockchain   9

History of Blockchain – Decentralization – Generic Elements of Blockchain – Addresses – Transaction – Block – Contents of a Block – Block Header - State Machine – Nodes– Types of Blockchain.

Unit III   Consensus in Blockchain   9

Fault tolerance – Paxos – Consensus – Byzantine Agreement – Proof of Work – Proof of Stake – Proof of Elapsed Time – Proof of Importance – Practical Byzantine Fault Tolerance – CAP Theorem - Mining – How blockchain accumulates block.

Unit IV   Hyperledger for Blockchain   9

Hyperledger as a protocol – Fabric – Sawtooth lake – Reference Architecture – Privacy and Confidentiality – Fabric Architecture – Components of the fabric – Blockchain services – API's and CLI's.

Unit V   Applications of Blockchain   6

Bitcoin – Cryptocurrency – Smart Contracts – Financial Applications – IoT Blockchain Applications – Government Applications – Blockchain Security.

Total Hours:45

Course Outcomes:

At the end of the course, the students will be able to,

- Elucidate the requirements of a blockchain
- Design and develop a simple blockchain based application
- Deploy sample applications over Hyperledger
- Explain the requirement of mining in blockchain

References

1. Imran Bashir, "Mastering Blockchain", Packt Publishing 2017.
2. Melanie Swan, "Blockchain - Blueprint for a New Economy", O'Reilly Media, 2015
3. Roger Wattenhofer, "The science of the blockchain", Inverted Forest Publishing, 2016
4. www.blockchain.io
5. www.blockchain.org

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INTERNET OF THINGS AND SECURITY   L   T   P   C

                                                                 3   1   0   4

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Course Objectives:

The students will be able to

- Understand the fundamentals of Internet of Things
- Fabricate a low cost embedded system using Raspberry Pi or Arduino
- Apply IoT in Real world scenario

Unit I   Fundamentals of IoT   12

The flavour of the Internet – Technology of IoT – Enchanted objects – Design principles for connected device – Privacy – Webthinking – Affordance.

Unit II   Internet Principles   12

Internet Communications – IP, TCP – Protocol suite – UDP – IP Addresses – TCP and UDP ports – MAC Address – Application Layer Protocols.

Unit III   Prototyping Embedded Devices   12

Prototypes and production - Open source versus closed source - Tapping into the community – Electronics - Embedded computing basics – Arduino - Raspberry pi - electric imp – plug computing.

Unit IV   Prototyping Physical and Online Components   12

Preparation, sketch, iterate and explore - Non digital methods - Laser cutting - 3D printing – Getting started with API – Writing a new API – Real time reactions – Memory Management.

Unit V   Prototype to Business Models   12

Business model canvas – Models - Funding an internet of things startup – Scaling up Software – Ethics: Privacy – Control – Environment – Solutions.

Total Hours:60(L:45+T:15)

Course Outcomes:

At the end of the course, the students will be able to,

- Analyze various protocols of IoT
- Design a portable IoT application using Raspberry Pi or Arduino
- Deploy an IoT application to the cloud.
- Analyze applications of IoT in real time scenario

References

1. Adrian McEwen, Hakim Cassimally, Designing the Internet of Things, 1/e, Wiley publication, 2013
2. Charalampos Doukas , Building Internet of Things with the Arduino, Create space, 2002.
3. Dieter Uckelmann (et.al), Architecting the Internet of Things, Springer, 2011.

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IOT AND BLOCKCHAIN LABORATORY   L   T   P   C

                                                           0   0   3   2
</div>

Course Objectives:

The students will be able to

- Understand the basics of Arduino/ Raspberry Pi programming
- Learn to develop simple blockchain applications.

Arduino and Raspberry Pi

1. Arduino programming to make the LED Blink with and without delay
2. Serial Communication in Arduino with Wireless Module and Programming
3. Bluetooth (HC-05) and ZigBee (TI -CC2500)
4. Programming the Raspberry Pi to make the LED Blink using Python
5. Integration of sensors/components with Raspberry Pi and Programming
6. Serial Communication Between Arduino and Raspberry Pi using Universal Serial Bus(USB)

Security in Arduino and Raspberry Pi

7. Implementation of MD5, SHA1, SHA256 in Arduino/Raspberry Pi using Hash Functions.
8. Implementation of DES and AES Algorithms in Arduino/Raspberry Pi using Arduino Cryptographic Library.

Blockchain Implementation

9. Implementation of basic Hash algorithms required for Blockchain
10. Developing simple applications using Hyperledger framework
11. Developing simple applications using Ethereum framework
12. Simulation of mining in Blockchain
13. Implementation of ethereum smart contracts

Total Hours:45

Course Outcomes:

At the end of the course, the students will be able to,

- Develop simple applications using Arduino/ Raspberry Pi
- Create simple applications using blockchain tools

LIST OF EQUIPMENT FOR A BATCH OF 18 STUDENTS:

SOFTWARE:
Windows/Ubuntu/ Kali Linux with C/C++/Java/Python
Cisco Packet Tracer, Snort IDS, Eclipse or equivalent IDE
HARDWARE:
Standalone desktops - 18
IoT Kit - 18

DIGITAL FORENSICS LABORATORY	L	T	P	C
	0	**0**	**3**	**2**

Course Objectives:

The students will be able to

- Perform basic digital forensics.
- Demonstrate the use of simple digital forensics tools.
- Conduct a digital forensics exercise.

List of Exercises
Disk Imaging and Cloning
1. Use VMWare and modify device configuration in a VMWare system

Analying disk structure and file systems
2. The Sleuth Kit Tools

Search Word Filtering from Unallocated, Slack and Swap Space
Unix File Recovery – Data Unit Level
3. Review of unallocated space and extracting with dls

FILE RECOVERY: META DATA LAYER
4. Find meta data information for evidence found in a search list
Keyword Searches, Timelines, Hidden Data

Data Mining for Digital Forensics

5. Encryption and Password Recovery
6. Steganography Detection
7. File Extension Renaming and Signaturing
8. Application Analysis
9. Client and Web Analysis
10. Network Analysis

Total Hours:45

Course Outcomes:
At the end of the course, the students will be able to,
• Practice and gain basic knowledge about VMware and various file system
• Analyze and recover the data using various forensic tools

LIST OF EQUIPMENT FOR A BATCH OF 18 STUDENTS:

SOFTWARE:
Ubuntu/ Kali Linux with C/C++/Java/Python
Sleuth Kit, Wireshark, VMWare, OWASP, DVWA
HARDWARE:
Standalone desktops - 18

APPLIED CRYPTOGRAPHY	**L**	**T**	**P**	**C**
	3	**0**	**0**	**3**

Course Objectives:
The students will be able to
• Understand basic encryption methods and algorithms, he strengths and weaknesses of encryption algorithms.
• Understand encryption key exchange and management
• Gain knowledge on hashing and its applications

Unit I   Cryptography and Computational Hardness   9

Introduction -Private Key Cryptography - Public Key Cryptography - Hash functions - Digital Signature - Multiplication, Primes, and Factoring - Hardness Amplification - Collections of One-Way Functions - Basic Computational Number Theory - Factoring-based Collection of OWF - Discrete Logarithm-based Collection

Unit II   Indistinguishability and Pseudo-Randomness   9

RSA Collection - One-way Permutations - Trapdoor Permutations - Rabin collection - A Universal One Way Function - Computational Indistinguishability - Pseudo-random generators - Hard-Core Bits from Any OWF - Secure Encryption - An Encryption Scheme with Short Keys - Multi-message Secure Encryption - Pseudorandom Functions - Construction of Multi-message Secure Encryption - Public Key Encryption - El-Gamal

Public Key Encryption scheme - A Note on Complexity Assumptions

Unit III   Public Key and Private Key Cryptosystems   9

Chosen plaintext attack - Security against multi-key attacks - Building CPA secure ciphers - Nonce based encryption - Message integrity - Message integrity from Universal Hashing - Elliptic Curve cryptography and pairings - Analysis of number theoretic assumptions

Unit IV   Protocols for Cryptography   9

Protocols for Identification and Login - Authenticated Encryption - Identification and signatures from sigma protocols - Combining Sigma protocols - Witness independence and applications - Proving properties in zero-knowledge

Unit V   Protocols for Key Exchange   9

Authenticated Key exchange - HSM security - One-sided Authentication - Deniability - Password authenticated key exchange - Secure multi-party computation - Evaluating arithmetic circuits - Garbled circuits - Formal models for multiparty communication

Total Hours:45

Course Outcomes:

At the end of the course, the students will be able to,
- Understand the algorithms used for constructing cryptographic computations
- Understand the concept and correctness of cryptographic protocols.
- Understand the methods used for encryption, authentication, integrity, certification and data privacy.
- Understand the complex protocols that involve many steps and computing agents, who do not trust each other.
- Understand how seemingly impossible electronic transactions can be performed

References

1. Rafael Pass and Abhi Shelat, "A Course in Cryptography", Third edition: January 2010
2. Dan Boneh and Victor Shoup, "A Graduate Course in Applied Cryptography", January 2020.
3. William Stallings, "Cryptography and Network Security: Principles and Practices", Seventh Edition, Pearson Education, 2017.
4. Matt Bishop ,"Computer Security art and science ", Second Edition, Pearson Education, 2002

<div align="center">**MACHINE LEARNING TECHNIQUES**</div>

L	T	P	C
3	0	0	3

Course Objectives:

The students will be able to

- To introduce students to the basic concepts and techniques of Machine Learning.
- To have a thorough understanding of the Supervised and Unsupervised learning techniques.
- To study the various probabilities based learning techniques.

Unit I   Introduction to Machine Learning Techniques   9

Learning – Types of Machine Learning – Supervised Learning – The Brain and the Neuron – Design a Learning System – Perspectives and Issues in Machine Learning – Concept Learning Task – Concept Learning as Search – Finding a Maximally Specific Hypothesis – Version Spaces and the Candidate Elimination Algorithm – Linear Discriminants – Perceptron – Linear Separability – Linear Regression.

Unit II   Linear Models   9

Multi-layer Perceptron – Going Forwards – Going Backwards: Back Propagation Error – Multilayer Perceptron in Practice – Examples of using the MLP – Overview – Deriving Back Propagation – Radial Basis Functions and Splines – Concepts – RBF Network – Curse of Dimensionality – Interpolations and Basis Functions – Support Vector Machines Virtual.

Unit III   Tree and Probabilistic Models   9

Learning with Trees – Decision Trees – Constructing Decision Trees – Classification and Regression Trees – Ensemble Learning – Boosting – Bagging – Different ways to Combine Classifiers – Probability and Learning – Data into Probabilities – Basic Statistics – Gaussian Mixture Models – Nearest Neighbor Methods – Unsupervised Learning – K means Algorithms – Vector Quantization – Self Organizing Feature Map.

Unit IV   Dimensionality Reduction and Evolutionary Models   9

Dimensionality Reduction – Linear Discriminant Analysis – Principal Component Analysis – Factor Analysis – Independent Component Analysis – Locally Linear Embedding – Isomap – Least Squares Optimization – Evolutionary Learning – Genetic algorithms – Genetic Offspring: - Genetic Operators – Using Genetic Algorithms – Reinforcement Learning – Overview – Getting Lost Example – Markov Decision Process.

Unit V   Graphical Models   9

Markov Chain Monte Carlo Methods – Sampling – Proposal Distribution – Markov Chain Monte Carlo – Graphical Models – Bayesian Networks – Markov Random Fields – Hidden Markov Models – Tracking Methods.

<div align="right">**Total Hours:45**</div>

Course Outcomes:

At the end of the course, the students will be able to,

- Distinguish between, supervised, unsupervised and semi-supervised learning
- Apply the apt machine learning strategy for any given problem
- Suggest supervised, unsupervised or semi-supervised learning algorithms for given problem
- Design systems that uses the appropriate graph models of machine learning

References

1. Ethem Alpaydin, "Introduction to Machine Learning 3e (Adaptive Computation and Machine Learning Series)", Third Edition, MIT Press, 2014
2. Jason Bell, "Machine learning – Hands on for Developers and Technical Professionals", First Edition, Wiley, 2014
3. Peter Flach, "Machine Learning: The Art and Science of Algorithms that Make Sense of Data", First Edition, Cambridge University Press, 2012.
4. Stephen Marsland,"Machine Learning – An Algorithmic Perspective", Second Edition, Chapman and Hall, CRC Machine Learning and Pattern Recognition Series, 2014.

DATA MINING TECHNIQUES	**L**	**T**	**P**	**C**
	3	**0**	**0**	**3**

Course Objectives:

The students will be able to

- Understand Data mining principles and techniques and Introduce DM as a cutting edge business intelligence
- Explore the concepts of Datawarehousing Architecture and Implementation
- Study the overview of developing areas – Web mining, Text mining and ethical aspects of Datamining
- Identify Business applications and Trends of Data mining

Unit I   Introduction to Data Warehousing   9

Evolution of Decision Support Systems- Data warehousing Components – Building a Datawarehouse, Data Warehouse and DBMS, Data marts, Metadata, Multidimensional data model, OLAP vs OLTP, OLAP operations, Data cubes, Schemas for Multidimensional Database: Stars, Snowflakes and Fact constellations

Unit II   Data Warehouse Process and Architecture   9

Types of OLAP servers, 3–Tier data warehouse architecture, distributed and virtual data warehouses. Data warehouse implementation, tuning and testing of data warehouse. Data Staging (ETL) Design and Development, data warehouse visualization, Data Warehouse Deployment, Maintenance, Growth, Business Intelligence Overview- Data Warehousing and Business Intelligence Trends - Business Applications- tools-SAS

Unit III   Introduction to Data Mining   9

Data mining-KDD versus datamining, Stages of the Data Mining Process-task premitives, Data Mining Techniques -Data mining knowledge representation – Data mining query languages, Integration of a Data Mining System with a Data Warehouse – Issues, Data preprocessing – Data cleaning, Data transformation, Feature selection, Dimensionality reduction, Discretization and generating concept hierarchies-Mining frequent patterns- association-correlation

Unit IV   Classification and Clustering   9
Decision Tree Induction - Bayesian Classification – Rule Based Classification – Classification by Backpropagation – Support Vector Machines – Associative Classification – Lazy Learners – OtherClassification Methods – Clustering techniques – , Partitioning methods- k-means- HierarchicalMethods – distance based agglomerative and divisible clustering, Density-Based Methods –expectation maximization -Grid Based Methods – Model-Based Clustering Methods – Constraint –Based Cluster Analysis – Outlier Analysis

Unit V   Predictive Modeling Of Big Data and Trends In Datamining   9
Statistics and Data Analysis – EDA – Small and Big Data –Logistic Regression Model – Ordinary Regression Model-Mining complex data objects – Spatial databases – Temporal databases – Multimedia databases – Time series and sequence data – Text mining – Web mining – Applications in Data mining

Total Hours:45

Course Outcomes:
At the end of the course, the students will be able to,

- Design Multidimensional Intelligent model from typical system
- Discover the knowledge imbibed in the high dimensional system
- Implement various mining techniques on complex data objects

References
1. Jiawei Han and Micheline Kamber, Data Mining: Concepts and Techniques, Morgan Kaufmann Publishers, third edition2011, ISBN: 1558604898.
2. Alex Berson and Stephen J. Smith, " Data Warehousing, Data Mining & OLAP", Tata McGrawHill Edition, Tenth Reprint 2007.
3. G. K. Gupta, "Introduction to Data Min Data Mining with Case Studies", Easter Economy Edition, Prentice Hall of India, 2006.
4. Data Mining:Practical Machine Learning Tools and Techniques,Third edition,(Then Morgan Kufmann series in Data Management systems), Ian.H.Witten, Eibe Frank and Mark.A.Hall, 2011
5. Statistical and Machine learning –Learning Data Mining, techniques for better Predictive Modeling and Analysis to Big Data

SOCIAL NETWORK ANALYSIS   L   T   P   C
                                                                 3   0   0   3

Course Objectives:
The students will be able to

- Understand the concepts of Social networks and Web Social Networks
- Appreciate the modelling and visualizing techniques associated with Social Networks

Unit I   Social Network Analysis Fundamentals   9
Introduction to Web - Limitations of current Web – Development of Semantic Web – Emergence of the Social Web – Statistical Properties of Social Networks -Network analysis – Development of Social Network Analysis - Key concepts and measures in network analysis – Discussion networks - Blogs and online communities - Web-based networks.

Unit II   Modeling and Visualization   9
Visualizing Online Social Networks - A Taxonomy of Visualizations - Graph Representation - Centrality- Clustering - Node-Edge Diagrams - Visualizing Social Networks with MatrixBased Representations- Node-Link Diagrams - Hybrid Representations - Modelling and aggregating social network data - RandomWalks and their Applications –Use of Hadoop and MapReduce - Ontological representation of social individuals and relationships.

Unit III   Mining Communities   9
Aggregating and reasoning with social network data, Advanced Representations – Extracting evolution of Web Community from a Series of Web Archive - Detecting Communities in Social Networks - Evaluating Communities – Core Methods for Community Detection & Mining - Applications of Community Mining Algorithms - Node Classification in Social Networks.

Unit IV   Evolution   9
Evolution in Social Networks – Framework - Tracing Smoothly Evolving Communities – Models and Algorithms for Social Influence Analysis - Influence Related Statistics - Social Similarity and Influence - Influence Maximization in Viral Marketing - Algorithms and Systems for Expert Location in Social Networks – Expert Team Formation - Link Prediction in Social Networks - Feature based Link Prediction - Bayesian Probabilistic Models - Probabilistic Relational Models.

Unit V   Text and Opinion Mining   9
Text Mining in Social Networks -Opinion extraction – Sentiment classification and clustering - Temporal sentiment analysis - Irony detection in opinion mining - Wish analysis - Product review mining – Review Classification – Tracking sentiments towards topics over time.

Total Hours:45

Course Outcomes:

At the end of the course, the students will be able to,

- Build a social network data set from existing social networking sites
- Identify the components of a web social network that can be used for analyzing and mining
- Identify the different data structures and graph algorithms that can be used for web social network mining

References

1. Charu C. Aggarwal, "Social Network Data Analytics", Springer; 2011
2. Peter Mika, "Social Networks and the Semantic Web", Springer, 1st edition 2007.
3. Borko Furht, "Handbook of Social Network Technologies and Applications",Springer, 1st edition, 2010.
4. Guandong Xu , Yanchun Zhang and Lin Li, "Web Mining and Social Networking – Techniques and applications", Springer, 1st edition, 2011.

PRINCIPLES OF SECURE CODING	L	T	P	C
	3	0	0	3

Course Objectives:

The students will be able to

- Explain security design principles
- Analyze and Design projects by applying security principles
- Implement projects using security primitives
- Utilize tools for security analysis

Unit I   Introduction to Security   9

Security goals- -Proactive Security development process, Secure Software Development Cycle (S-SDLC) , Security issues while writing SRS, Best Practices SD3 (Secure by design, default and deployment), Security principles and Secure Product Development Timeline, Security Design Principles.

Unit II   Secure Programming Techniques   9

Worms and other malware, Buffer overflows, client state manipulation, sql injection-password security-cross domain security in web applications.

Unit III   Secure coding   9

Safe initialization ,Access control, Input validation, buffer overflows, format String problems, Integer overflows, C++ catastrophes, Catching exceptions, command injection, information leakage, Race conditions, Poor usability executing code with too much privilege. Failure to,

protect stored data.

Unit IV   Database and Web-specific issues   9

SQL Injection Techniques and Remedies, Race conditions, Time of Check Versus Time of Use and its protection mechanisms. Validating Input and Interprocess Communication, Securing Signal Handlers and File Operations. XSS scripting attack and its types – Persistent and Non persistent attack XSS Counter measures and Bypassing the XSS Filters.

Unit V   Testing secure applications   9

Testing Secure Applications: Security code overview, secure software installation. The Role of the Security Tester, Building the Security Test Plan. Testing HTTP-Based Applications, Testing File-Based Applications, Testing Clients with Rogue Servers

Total Hours:45

Course Outcomes:

At the end of the course, the students will be able to,

- Elucidate the principles required for securing an organization
- Create secure projects for an organization
- Deploy projects and their security features
- Utilize the tools available for security and secure an organization

References

1. Foundations of Security, Daswani N., Kern C., Kesavan A., Apress
2. 24 Deadly Sins of Software Security: Programming Flaws and How to Fix Them by John Viega (Author), Matt Messier (Author)
3. Secure Programming Cookbook for C and C++,O'Reilly Media
4. Writing Secure Code, Michael Howard and David LeBlanc,Microsoft Press, 2nd Edition, 2004

TRUST MANAGEMENT IN E-COMMERCE	L	T	P	C
	3	0	0	3

Course Objectives:

The students will be able to

- Ecommerce business models and Digital Payments systems
- Knowledge about Ecommerce security Environment
- To study about Ecommerce mechanisms and trusted computing Platform.

Unit I   Introduction To E-Commerce   9

Introduction to E-Commerce – Network and E-Commerce – Types of E-Commerce –E-commerce Business Models, Major Business to Consumer (B2C) business models, Major Business to Business (B2B) business models, Business models in emerging E-commerce areas, How the Internet and the web change business: strategy, structure and process, The Internet: Technology Background, The Internet Today, Internet II- The Future Infrastructure.

Unit II   E-Commerce Security and Payment   9

E-commerce security environment, Security threats in the e-commerce environment, Technology solution, Management policies, Business procedures, and public laws, Payment system, E-commerce payment system, Electronic billing presentment and payment.

Unit III   Trust In E-Commerce   9

Inter-organizational trust in E-Commerce: Need – Trading partner trust – Perceived benefits and risks of E-Commerce – Technology trust mechanism in E-Commerce – Perspectives of organizational, economic and political theories of inter-organizational trust – Conceptual model of inter-organizational trust in E-Commerce participation.

Unit IV   Trusted Computing Platform   9

Introduction to trusted computing platform: Overview – Usage Scenarios – Key components of trusted platform – Trust mechanisms in a trusted platform.

Unit V   Trust Models   9

Trusted platforms for organizations and individuals – Trust models and the E-Commerce domain.

                                                                Total Hours:45

Course Outcomes:

At the end of the course, the students will be able to,

- Explain B2C,B2B,C2C,Business models
- Illustrate the Policies, Procedures and Laws and Security threats in E-Commerce environment.
- Analyze and explain the issues, risks and challenges in inter-organisational trust in Ecommerce
- Explain the Key components and Trust mechanisms of trusted computing platform.
- Describe the Trusted platforms for organizations and individuals

References

1. S. J. Joseph, E-Commerce: an Indian perspective, PHI
2. Kenneth C. Laudon and Carol Guercio Trave, ―E-Commerce Business Technology Society‖, 12th Edition Pearson Education, 2016.
3. Pauline Ratnasingam, ―Inter-Organizational Trust for Business-to-Business E-Commerce‖, IRM Press, 2005.
4. Siani Pearson, et al, ―Trusted Computing Platforms: TCPA Technology in Context‖ Prentice Hall PTR, 2002.

<div align="center">**BIOMETRIC IMAGE PROCESSING**</div>

L	T	P	C
3	0	0	3

Course Objectives:

The students will be able to

- Understand the basics of Image processing
- Model and picture the transformation of image
- Understand the growth of object detection

Unit I   Image Processing Essentials   9

Human vision system – Computer vision system – Image formation – Fourier Transform – Sampling Criteria – Histograms – Point operators – Group operations – Statistical operations – Mathematical morphology.

Unit II   Feature Extraction: Edge detection and Fixed shape matching   9

Edge Detection- Phase congruency- Localized feature extraction- Describing image motion - Thresholding and subtraction - Template matching - Feature extraction by low-level features - Hough transform - Deformable shape analysis - Active contours (snakes).

Unit III   Object Detection and Description   9

Boundary descriptions - Region descriptors - Texture description – Classification – Segmentation - Moving object detection - Tracking moving features - Moving feature extraction and description.

Unit IV   Voice and Hand Biometrics   9

Voice biometric techniques - Acoustic analysis for robust speaker recognition - Distributed speaker recognition through UBM–GMM models – Hand Biometrics: Characterization by minutiae extraction – Sample Databases.

Unit V   Multi biometrics and Visual Data Protection   9

Different principles of multi biometrics - Fusion levels - Applications and illustrations - Biometrics using ECG - Biometrics using medical imaging – Parametric and Non-parametric approaches for classification - Visual data hiding Security.

<div align="right">**Total Hours:45**</div>

Course Outcomes:

At the end of the course, the students will be able to,

- Explain the necessity of image processing
- Able to discriminate various techniques for feature extraction
- Able to differentiate the techniques for object detection
- Characterize various tools for biometrics
- Protect the data using data protection techniques

References

1. Amine Nail -Ali and Regis Fournier "Signal and Image Processing for Biometrics" John Wiley and sons,2012
2. Mark S.Nixon, Alberto S.Aguado, Feature Extraction and image processing for computer vision, Third Edition, , Elsevier 2012.
3. Scott E Baugh "Digital Image Processing and analysis" 2nd Edition CRC Press 2010

CYBER SECURITY MANAGEMENT AND CYBER LAWS	L	T	P	C
	3	0	0	3

Course Objectives:

The students will be able to

*   Understand the need of Cyber Security
*   Explore the laws governing Cyber Security
*   Gain knowledge on Cyber Security Management

Unit I   Fundamentals of Cyber Security   9

Introduction-Cyber Security and its problem-Intervention Strategies: Redundancy, Diversity and Autarchy.

Unit II   Issues in Cyber Security   9

Private ordering solutions, Regulation and Jurisdiction for global Cyber security, Copy Right-source of risks, Pirates, Internet Infringement, Fair Use, postings, criminal liability, First Amendments, Data Loss.

Unit III   Intellectual Property Rights   9

Copy Right-Source of risks, Pirates, Internet Infringement, Fair Use, postings, Criminal Liability, First Amendments, Losing Data, Trademarks, Defamation, Privacy-Common Law Privacy, Constitutional law, Federal Statutes, Anonymity, Technology expanding privacy rights.

Unit IV   Procedural Issues   9

Duty of Care, Criminal Liability, Procedural issues, Electronic Contracts & Digital Signatures, Misappropriation of information, Civil Rights, Tax, Evidence.

Unit V   Legal Aspects of Cyber Security   9

Ethics, Legal Developments, Late 1990 to 2000, Cyber security in Society, Security in cyber laws case. studies, General law and Cyber Law-a Swift Analysis

Course Outcomes:

At the end of the course, the students will be able to,

- Explain ethical laws of computer for different countries
- Explore the needs on copy right issues of software's
- Analyze the issues those are specific to amendment rights

References

1. Jonathan Rosenoer,"Cyber Law: The law of the Internet", Springer-Verlag, 1997.
2. Mark F Grady, Fransesco Parisi, "The Law and Economics of Cyber Security", Cambridge University Press, 2006
3. Michael Graves, ―Digital Archaeology: The Art and Science of Digital Forensics, Addison-Wesley Professional, 2014

NETWORK VIRTUALIZATION	L	T	P	C
	3	0	0	3

Course Objectives:

The students will be able to

- Understand the need for Virtualization
- Get a practical knowledge on VMWare tools

Unit I   Virtualization Fundamentals   9

Virtualization-need, Virtualization Technologies :Server Virtualization, Hardware emulation, Storage Virtualization, Network-attached storage, Storage area networks, I/O Virtualization, Network Virtualization, Client Virtualization, Application virtualization, Desktop virtualization, Case study: Studying Server Consolidation, Development and Test Environments , Quality of Service, Simple failover High availability, Clustering ,Data mirroring, Data replication, IT Operational Flexibility, Load balancing, Server pooling, Helping with Disaster Recovery, Rethinking Virtualization in Business Terms : Rethinking Infrastructure Virtualization, Benefits of Virtualization.

Unit II   VMWare Virtualization   9

Virtual machines, and vSphere components, server, network, and storage virtualization, vSphere. Create Virtual Machine VMware vCenter Server: Introduction to vCenter Server architecture and appliance, Virtual Machine Management: Deploy virtual machines using templates and cloning, Modify and manage virtual machines, Create and manage virtual machine snapshots, Perform VMware vSphere vMotion and Storage vMotion migrations, Create a vSpherevApp.

Unit III   Access and Authentication Control   9

Control user access through roles and permissions, Configure and manage the ESXi firewall, Configure ESXi lockdown mode, Integrate ESXi with Active Directory, Introduce VMware

vShield Zones.

Unit IV   Installing VMWare Components   9

Introduce ESXi installation, Describe boot from SAN requirements, Introduce vCenter Server deployment options, Describe vCenter Server hardware, software, and database requirements, Install vCenter Server (Windows based).

Unit V   Implement and Configure Window Server 2008 Hyper V   9

Configure Hyper V Virtual Networking, Configure and use Hyper V remote administration, Create and configure Virtual Hard Drives, Use Virtual Machine snapshots, Describe considerations for configuring Hyper-V servers for high availability, Virtual Machine Manager (VMM) features and use VMM to manage virtual machines.

Total Hours:45

Course Outcomes:

At the end of the course, the students will be able to,

- Explain the requirement for network virtualization
- Manage the VMWare tools
- Implement and configure the system using Virtualization tools

References

1. Virtualization: a beginner's guide - Danielle Ruest, Nelson Ruest , McGraw-Hill Prof Med, 2010.
2. Windows Server 2008 Hyper-V: Insiders Guide to Microsoft's Hypervisor By John Kelbley, Mike Sterling, Allen Stewart, Sybex; 1 edition (April 20, 2009).
3. Virtualization for Dummies - Bernard Golden, For Dummies; 1 edition (December 5, 2007).
4. Mastering Microsoft Virtualization - Tim Cerling, Jeffrey Buller, Jeffrey L. Buller, Sybex; 1 edition (December 21, 2009).

CLOUD COMPUTING TECHNOLOGIES	**L**	**T**	**P**	**C**
	3	**0**	**0**	**3**

Course Objectives:

The students will be able to

- Gain knowledge on the concept of virtualization that is fundamental to cloud computing
- Understand the various issues in cloud computing
- Be able to set up a private cloud

Unit I   Virtualization In Cloud   9

Basics of Virtual Machines - Process Virtual Machines – System Virtual Machines –Emulation –Interpretation – Binary Translation - Taxonomy of Virtual Machines. Virtualization – Management Virtualization –– Hardware Maximization – Architectures – Virtualization Management – Storage Virtualization – Network Virtualization.

Unit II   Virtualization Infrastructure   9

Comprehensive Analysis – Resource Pool – Testing Environment –Server Virtualization – Virtual Workloads – Provision Virtual Machines – Desktop Virtualization – Application Virtualization - Implementation levels of virtualization – virtualization structure – virtualization of CPU, Memory and I/O devices – virtual clusters and Resource Management – Virtualization for data center automation.

Unit III   Cloud Platform Architecture   9

Cloud deployment models: public, private, hybrid, community – Categories of cloud computing: Everything as a service: Infrastructure, platform, software- A Generic Cloud Architecture Design – Layered cloud Architectural Development – Virtualization Support and Disaster Recovery –Architectural Design Challenges - Public Cloud Platforms : GAE,AWS – Inter-cloud Resource Management.

Unit IV   Programming Model   9

Introduction to Hadoop Framework - Mapreduce, Input splitting, map and reduce functions, specifying input and output parameters, configuring and running a job –Developing Map Reduce Applications - Design of Hadoop file system –Setting up Hadoop Cluster - Cloud Software Environments -Eucalyptus, Open Nebula, Open Stack, Nimbus.

Unit V   Cloud Security   9

Cloud Infrastructure security: network, host and application level – aspects of data security, provider data and its security, Identity and access management architecture, IAM practices in the cloud, SaaS, PaaS, IaaS availability in the cloud - Key privacy issues in the cloud –Cloud Security and Trust Management.

Total Hours:45

Course Outcomes:

At the end of the course, the students will be able to,

- Employ the concepts of storage virtualization, network virtualization and its management
- Apply the concept of virtualization in the cloud computing
- Identify the architecture, infrastructure and delivery models of cloud computing

References

1. Danielle Ruest, Nelson Ruest, "Virtualization: A Beginner‟s Guide", McGraw-Hill Osborne Media, 2009.

2. Jim Smith, Ravi Nair , "Virtual Machines: Versatile Platforms for Systems and Processes", Elsevier/Morgan Kaufmann, 2005
3. John W.Rittinghouse and James F.Ransome, "Cloud Computing: Implementation, Management, and Security", CRC Press, 2010.
4. Kai Hwang, Geoffrey C Fox, Jack G Dongarra, "Distributed and Cloud Computing, From Parallel Processing to the Internet of Things", Morgan Kaufmann Publishers, 2012.

<div align="center">

ENERGY AWARE COMPUTING

</div>

L	T	P	C
3	0	0	3

Course Objectives:

The students will be able to

*   Understand the fundamentals of Energy Efficient Computing
*   Understand the concept of Energy Efficient Storage Systems
*   Introduce the various types of scheduling algorithms in energy efficient computing
*   Introduce the concept of Green Networking
*   Study Energy Aware Applications

Unit I   Introduction   9

Subreshold Computing – Energy Efficient Network-on-Chip Architectures for Multi-Core Systems-Energy-Efficient MIPS CPU Core with Fine-Grained Run-Time Power Gating –Low Power design of Emerging memory technologies.

Unit II   Energy Efficient Storage   9

Disk Energy Management-Power Efficient Strategies for Storage Systems-Dynamic thermal management for high performance storage systems- Energy-Saving Techniques for Disk Storage Systems.

Unit III   Energy Efficient Scheduling Algorithms   9

Algorithms and Analysis of Energy-Efficient Scheduling of Parallel Tasks- Dynamic Voltage Scaling- Speed Scaling - Processor optimization-Online job scheduling Algorithms.

Unit IV   Green Networking   9

Power-Aware Middleware for Mobile Applications -Energy Efficiency of Voice-over-IP Systems - Intelligent Energy-Aware Networks - Green TCAM-Based Internet Routers.

Unit V   Energy Aware Computing Applications   9

On-Chip Network-Video Codec Design-Energy Aware Surveillance Camera -Low Power Design Challenge in Biomedical Implant Electronics.

Total Hours:45

Course Outcomes:

At the end of the course, the students will be able to,

- Design Power efficient architecture Hardware and Software
- Analyze the different types of Energy Efficient Storage systems.
- Design the algorithms for Energy Efficient Systems
- Identify the different types of Green Networking schemes in the energy efficient
- computing
- Explore the applications of Energy Aware Computing

References

1. Bob steiger wald ,Chris:Luero, Energy Aware computing, Intel Press,2012
2. Chong -Min Kyung, Sungioo yoo, Energy Aware system design Algorithms and Architecture, Springer, 2011.
3. Ishfaq Ah mad, Sanjay Ranka, Handbook of Energy Aware and Green Computing, CRC Press, 2012

ADVANCED INFRASTRUCTURE MANAGEMENT	L	T	P	C
	3	0	0	3

Course Objectives:

The students will be able to

- Understand the requirements of Infrastructure management
- Get a firm knowledge on various storage technologies
- Know the need for network and cloud management

Unit I   Infrastructure Management Overview   9

Infrastructure management activities, Preparing for Infrastructure Management Factors to consider in designing IT organizations and IT infrastructure, Determining customer's Requirements, Identifying System Components to manage, Exist Processes, Data, applications, Tools and their integration, Patterns for IT systems management, Introduction to the design process for information systems, Models, Information Technology Infrastructure Library (ITIL).

Unit II   Different Storage Technologies and Virtualization   9

Challenges in Data Storage and Management, Data Storage Infrastructure. Components of a Storage System Environment,Intelligent Storage System (ISS) and its components, Introduction to Networked Storage: Evolution of networked storage, Architecture, Overview of FC-SAN, NAS, and IPSAN. Network-Attached Storage (NAS): Benefits of NAS, Components, Implementations, File Sharing, I/O operations, Content Addressed Storage (CAS): CAS Architecture, Storage and Retrieval, Examples. Storage Virtualization: Forms, Taxonomy, Configuration, Challenges, Types of Storage Virtualizations.

Unit III   Network Infrastructure   9

Implementing, Managing and Maintaining IP Addressing; Configure TCP/IP addressing on a server computer using DHCP; Implementing, Managing and Maintaining Name Resolution using DNS Server; Implementing, Managing and Maintaining Routing and Remote Access; Configure remote access authentication protocols; Implement secure access between private networks; Manage Routing and Remote Access routing interfaces; Maintaining a Network Infrastructure.

Unit IV   Cloud Infrastructure   9

Architectural Design of Compute and Storage Clouds, Layered Cloud Architecture Development, Design Challenges, Inter Cloud Resource Management, Resource Provisioning and Platform Deployment, Global Exchange of Cloud Resources. Administrating the Clouds, Cloud Management Products, Emerging Cloud Management Standards.

Unit V   Case Study   9

Devops Infrastructure Management, Container Infrastructure Management, Engine yard PaaS, Docker Infrastructure Management.

                                                              Total Hours:45

Course Outcomes:

At the end of the course, the students will be able to,

- Differentiate various storage technologies
- Manage the cloud and network infrastructure
- Impart various infrastructure management policies for an organization

References

1. G. Somasundaram, Alok Shrivastava, EMC Educational Services, Information Storage and Management, Wiley India.
2. Robert Spalding, "Storage Networks: The Complete Reference", Tata McGraw Hill, Osborne, 2003.
3. Marc Farley, "Building Storage Networks", Tata McGraw Hill, Osborne, 2001.
4. Jan Van Bon, "Foundations of IT Service Management: based on ITIL", Van Haren Publishing, 2005.

INTRUSION DETECTION AND PREVENTION SYSTEMS	**L**	**T**	**P**	**C**
	3	**0**	**0**	**3**

Course Objectives:

The students will be able to

- Understand the state of the art of intrusion detection system
- Design and implement Intrusion Detection System

- Understand the classes of attacks on computer systems
- Identify various types of IDS of signature based and anomaly based techniques to solve problems related to intrusion detection and prevention.

Unit I   Introduction   9

Understanding Intrusion Detection – Intrusion detection and prevention basics – IDS and IPS analysis schemes, Attacks, Detection approaches –Misuse detection – anamoly detection – specification based detection – hybrid detection-methodologies-Signature & Anomaly based Detection, Stateful protocol analysis Types of IDS, Information sources Host based information sources, Network based information sources.

Unit II   Theoretical Foundations of Detection Technologies   9

Taxonomy of anomaly detection system – fuzzy logic – Bayes theory – Artificial Neural networks – Support vector machine - IDS TECHNOLOGIES: Components & Architecture-Typical components, Network Architectures Security capabilities - Information gathering capabilities, logging capabilities, detection & prevention capabilities. Network protocol based IDS, Hybrid IDS, and Analysis schemes.

Unit III   Network Based IDS   9

Networking Overview- OSI layers. Components and Architecture - Typical components, Network architectures and sensor locations. Security capabilities Wireless IDPS - Wireless Networking overview- WLAN standards & components. Components Network Behaviour analysis system.

Unit IV   Host Based IDS   9

Components and Architecture-Typical components, Network architectures, Agent locations, host architectures. Security capabilities-Logging, detection, prevention and other capabilities. Using & Integrating multiple IDPS technologies-Need for multiple IDPS technologies, Integrating different IDPS technologies-Other technologies with IDPS capabilities, Anti - malware technologies, Firewalls and Routers, Honeypots.

Unit V   Applications and Snort Tools   9

Tool Selection and Acquisition Process - Bro Intrusion Detection – Prelude Intrusion Detection - Cisco Security IDS - Snorts Intrusion Detection – NFR security - Introduction to Snort, Working with Snort Rules, Snort configuration, Snort with MySQL, Running Snort on Multiple Network Interfaces.

Total Hours:45

Course Outcomes:
At the end of the course, the students will be able to,

- Explain the need for anomaly detection and its types
- Differentiate various IDS technologies
- Configure a network using IDS tools

- Configure a server and its hosts for realtime Intrusion Detection
- Select and install a IDS system such as Snort to secure the network

References

1. Carl Endorf, Eugene Schultz and Jim Mellander " Intrusion Detection & Prevention" , 1st Edition, Tata McGraw-Hill, 2006
2. Ali A. Ghorbani, Wei Lu, "Network Intrusion Detection and Prevention: Concepts and Techniques", Springer, 2010.
3. Karen Scarfone, Peter Mell," Guide to Intrusion Detection and Prevention Systems (IDPS)", NIST special publication, 2007.
4. Stephen Northcutt, Judy Novak : "Network Intrusion Detection", 3rd Edition, New Riders Publishing, 2002.
5. Paul E. Proctor, "The Practical Intrusion Detection Handbook ", Prentice Hall , 2001.
6. Rafeeq Rehman : " Intrusion Detection with SNORT, Apache,MySQL, PHP and ACID," 1st Edition, Prentice Hall , 2003

DATA ANALYTICS AND BUSINESS INTELLIGENCE	L	T	P	C
	3	0	0	3

Course Objectives:

The students will be able to

- Understand linear and logistic regression models
- Understand simulation using regression models
- Understand data collection and model understanding

Unit I   Linear Regression   9

Introduction to data analysis – Statistical processes – statistical models – statistical inference – review of random variables and probability distributions – linear regression – one predictor – multiple predictors – prediction and validation – linear transformations – centering and standardizing – correlation – logarithmic transformations – other transformations – building regression models – fitting a series of regressions.

Unit II   Logistic and Generalized Linear Models   9

Logistic regression – logistic regression coefficients – latent-data formulation – building a logistic regression model – logistic regression with interactions – evaluating, checking, and comparing fitted logistic regressions – identifiability and separation – Poisson regression – logistic-binomial model – Probit regression – multinomial regression – robust regression using t model – building complex generalized linear models – constructive choice models.

Unit III   Simulation and Causal Inference   9

Simulation of probability models – summarizing linear regressions – simulation of non-linear predictions – predictive simulation for generalized linear models – fake-data simulation –

simulating and comparing to actual data – predictive simulation to check the fit of a time-series model – causal inference – randomized experiments – observational studies – causal inference using advanced models – matching – instrumental variables.

Unit IV   Multilevel Regression   9
Multilevel structures – clustered data – multilevel linear models – partial pooling – group-level predictors – model building and statistical significance – varying intercepts and slopes – scaled inverse-Wishart distribution – non-nested models – multi-level logistic regression – multi-level generalized linear models.

Unit V   Data Collection and Model Understanding   9
Design of data collection – classical power calculations – multilevel power calculations – power calculation using fake-data simulation – understanding and summarizing fitted models – uncertainty and variability – variances – $R2$ and explained variance – multiple comparisons and statistical significance – analysis of variance – ANOVA and multilevel linear and general linear models – missing data imputation.

Total Hours:45

Course Outcomes:
At the end of the course, the students will be able to,

- Build and apply linear and logistic regression models
- Perform data collection, variance analysis and casual inference from data
- Build and apply multilevel regression models

References
1. Andrew Gelman and Jennifer Hill, "Data Analysis using Regression and multilevel/Hierarchical Models", Cambridge University Press, 2006.
2. Philipp K. Janert, "Data Analysis with Open Source Tools", O'Reilley, 2010.
3. Davinderjit Sivia and John Skilling, "Data Analysis: A Bayesian Tutorial, Second Edition, Oxford University Press, 2006.
4. Robert Nisbelt, John Elder, and Gary Miner, "Handbook of statistical analysis and data mining applications", Academic Press, 2009.

CLOUD COMPUTING TECHNOLOGIES	**L**	**T**	**P**	**C**
	3	**0**	**0**	**3**

Course Objectives:
The students will be able to

- Gain knowledge on the concept of virtualization that is fundamental to cloud computing
- Understand the various issues in cloud computing
- Be able to set up a private cloud

Unit I   Virtualization In Cloud   9

Basics of Virtual Machines - Process Virtual Machines – System Virtual Machines –Emulation –Interpretation – Binary Translation - Taxonomy of Virtual Machines. Virtualization – Management Virtualization –– Hardware Maximization – Architectures – Virtualization Management – Storage Virtualization – Network Virtualization.

Unit II   Virtualization Infrastructure   9

Comprehensive Analysis – Resource Pool – Testing Environment –Server Virtualization – Virtual Workloads – Provision Virtual Machines – Desktop Virtualization – Application Virtualization - Implementation levels of virtualization – virtualization structure – virtualization of CPU, Memory and I/O devices – virtual clusters and Resource Management – Virtualization for data center automation.

Unit III   Cloud Platform Architecture   9

Cloud deployment models: public, private, hybrid, community – Categories of cloud computing: Everything as a service: Infrastructure, platform, software- A Generic Cloud Architecture Design – Layered cloud Architectural Development – Virtualization Support and Disaster Recovery –Architectural Design Challenges - Public Cloud Platforms : GAE,AWS – Inter-cloud Resource Management.

Unit IV   Programming Model   9

Introduction to Hadoop Framework - Mapreduce, Input splitting, map and reduce functions, specifying input and output parameters, configuring and running a job –Developing Map Reduce Applications - Design of Hadoop file system –Setting up Hadoop Cluster - Cloud Software Environments -Eucalyptus, Open Nebula, Open Stack, Nimbus.

Unit V   Cloud Security   9

Cloud Infrastructure security: network, host and application level – aspects of data security, provider data and its security, Identity and access management architecture, IAM practices in the cloud, SaaS, PaaS, IaaS availability in the cloud - Key privacy issues in the cloud –Cloud Security and Trust Management.

                                                                        Total Hours:45

Course Outcomes:
At the end of the course, the students will be able to,

- Employ the concepts of storage virtualization, network virtualization and its management
- Apply the concept of virtualization in the cloud computing
- Identify the architecture, infrastructure and delivery models of cloud computing

References
1. Danielle Ruest, Nelson Ruest, "Virtualization: A Beginner‟s Guide", McGraw-Hill

Osborne Media, 2009.
2. Jim Smith, Ravi Nair , "Virtual Machines: Versatile Platforms for Systems and Processes", Elsevier/Morgan Kaufmann, 2005
3. John W.Rittinghouse and James F.Ransome, "Cloud Computing: Implementation, Management, and Security", CRC Press, 2010.
4. Kai Hwang, Geoffrey C Fox, Jack G Dongarra, "Distributed and Cloud Computing, From Parallel Processing to the Internet of Things", Morgan Kaufmann Publishers, 2012.

WIRELESS SECURITY	**L**	**T**	**P**	**C**
	3	**0**	**0**	**3**

Course Objectives:
The students will be able to

- Gain in-depth knowledge on wireless and mobile network security and its relation to the new security based protocols.
- Apply proactive and defensive measures to counter potential threats, attacks and intrusions.
- Design secured wireless and mobile networks that optimise accessibility whilst minimising vulnerability to security risks.

Unit I   Introduction   9
Uniqueness of wireless- Wireless Information Warfare- Taxonomies of Wireless Communication Networks-Information Theory-Decision Theory-A Model for cost effective risk management-Performance measures.

Unit II   Security in WLAN   9
Wireless Transmission Media, WLAN Products and standards- securing WLAN - countermeasures-WAP-WTLS-Bluetooth-VoIP.

Unit III   Security in cellular Networks   9
Threats, Hacking and Viruses in mobile communications- Access control and Authentication in mobile communications.

Unit IV   Security in Adhoc Networks   9
Ad hoc Networking-Major Routing Protocol in Adhoc Networks- Attacks against Ad Hoc Networks, Securing Ad hoc Networks- Authentication in Ad hoc Networks – key Management – Intrusion Detection in Ad hoc Networks

Unit V   Security in RFID   9
Multi tag RFID systems-Attacking RFID systems-RFID Relay attacks-Physical privacy and security in RFID systems- Authentication Protocol in RFID systems-Lightweight Cryptography for Low-Cost RFID tags.

Total Hours:45

Course Outcomes:

At the end of the course, the students will be able to,

- attain knowledge of advanced security and privacy issues in wireless systems, including cellular and wireless LAN
- impart state-of-the-art technologies and protocols of wireless network security
- identify and investigate in-depth both early and contemporary threats to mobile and wireless networks security
- apply proactive and defensive measures to deter and repel potential threats, attacks and intrusions

References

1. Nichols, Randall K. ; Lekkas, Panos, "Wireless Security : Models, Threats, And Solutions", McGraw Hill Professional, 2002.
2. Yan Zhang and Paris Kitsos, "Security in RFID and Sensor Networks", CRC PRESS, 2009.
3. Noureddine Boudriga, "Security of Mobile Communications", ISBN 9780849379413, 2010.

MALWARE ANALYSIS AND REVERSE ENGINEERING	L	T	P	C
	3	0	0	3

Course Objectives:
The students will be able to

- Gain in-depth knowledge on fundamentals of malware analysis.
- Use JIT compilers for malware detection in legitimate code.
- Implement DNS filtering and apply reverse engineering.

Unit I Introduction to Malware Analysis 9
Introduction to key MA tools and techniques, Understanding Malware Threats, Malware indicators, Malware Classification, Introduction to MA Sandboxes Capturing and Analyzing Network Traffic, Internet simulation using INetSim, Using Deep Freeze to Preserve Physical Systems, Using FOG for Cloning and Imaging Disks.

Unit II Reverse Engineering Malware 9
Behavioural Analysis vs. Code Analysis, Resources for Reverse-Engineering Malware (REM) - Examining Clam AV Signatures, Creating Custom Clam AV Databases, Using YARA to Detect Malware Capabilities.

Unit III Malware Forensics 9
Using TSK for Network and Host Discoveries, Using Microsoft Offline API to Registry Discoveries , Identifying Packers using PEiD, Registry Forensics with Reg Ripper Plugins:, Bypassing Poison Ivy's Locked Files, Bypassing Conficker's File System ACL Restrictions, Detecting Rogue PKI Certificates.

Unit IV Malware and Kernel Debugging 9

Opening and Attaching to Processes, Configuration of JIT Debugger for Shellcode Analysis, Controlling Program Execution, Setting and Catching Breakpoints, Debugging with Python Scripts and Py Commands, DLL Export Enumeration, Execution, and Debugging, Debugging a VMware Workstation Guest (on Windows), Debugging a Parallels Guest (on Mac OS X).

Unit V   Memory Forensics and Volatility   9
Memory Dumping with MoonSols Windows Memory Toolkit, Accessing VM Memory Files Overview of Volatility, Investigating Processes in Memory Dumps, Code Injection and Extraction, Detecting and Capturing Suspicious Loaded DLLs, Finding Artifacts in Process Memory, Identifying Injected Code with Malfind and YARA.

Total Hours:45

Course Outcomes:
At the end of the course, the students will be able to,

- to understand the concept of malware and reverse engineering.
- Implement tools and techniques of malware analysis.
- apply proactive and defensive measures to deter and repel potential threats

References
1. Michael Sikorski, Andrew Honig, Practical Malware Analysis: The Hands-On Guide to Dissecting Malicious Software publisher William Pollock, 2012.
2. Michael Hale Ligh, Andrew Case, Jamie Levy, AAron Walters, The Art of Memory Forensics: Detecting Malware and Threats in Windows, Linux, and Mac Memory, 1st Edition, 2014.

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PENETRATION AND APPLICATION TESTING   L   T   P   C

3   0   0   3

</div>

OBJECTIVES:

- To understand and analyse entire penetration testing process including planning, reconnaissance, scanning, exploitation, post-exploitation, and result reporting
- To understand the fundamental information associated with methods employed and insecurities identified
- To develop an excellent understanding of current cybersecurity issues and ways that user, administrator, and programmer errors can lead to exploitable insecurities.

UNIT I   THE BASICS   9
Using Kali Linux – Linux File System – User Privilege – File permission – Data manipulation – Managing and Networking – Shell and python Scripting – Metasploit Framework

UNIT II   ASSESSMENTS AND EXPLOITATION   9
Finding Vulnerabilities – Nmap scripting engine – Metasploit Scanner – Metasploit exploit check functions – Web application scanning – Using wireshark to capture traffic – SSL attacks and

scripting – Exploiting WebDav credentials – Exploiting Open phpMyAdmin – Exploiting third party web appplications

UNIT III   EXPLOIT DEVELOPMENT   9

Stack based buffer overflow in Linux – Memory Theory – Linux Buffer overflow - Stack based buffer overflow in Windows – Causing a crash – Locating EIP – Structured exception handler – Fuzzing programs – Porting public exploits – Writing metasploit modules – Exploitation mitigation techniques

UNIT IV   POST EXPLOITATION   9

Client side exploitation – Bypassing filters – Client side attacks – Social Engineering – Bypassing Antivirus applications – Meterpreter – Local information gathering – Lateral movement – Pivoting – Persistence – Web Application testing – SQL injection – Xpath injection – Cross site scripting - Web application scanning with w3af.

UNIT V   WIRELESS AND MOBILE HACKING   9

Monitoring mode – Wired equivalent privacy – WPA2 – Wifi protected setup – Smartphone pentest framework – Mobile attack vectors – Remote and Client side attacks – Malicious apps – Mobile post exploitation.

TOTAL : 45 PERIODS

OUTCOMES:

Upon successful completion of this course, a student will be able to:

- understand professional and ethical responsibility, communicate effectively, understand the impact of security practices in a global and societal context
- understand vulnerabilities, mechanisms to identify vulnerabilities/threats/attacks
- apply knowledge of engineering to security evaluations, design and conduct security assessment experiments
- use techniques and modern engineering tools necessary for computer security engineering practice
- explain the technical workings of various penetration tests and produce reports based on them

References

1. Georgia Weidman, Penetration Testing – A hands-on introduction to hacking, No Scratch Press, 2014

2. Jon Erickson , Hacking: The Art of Exploitation, O'Reilly 2nd Edition

3. Rajat Khare, "Network Security and Ethical Hacking", Luniver Press, 2006

4. Ramachandran V, BackTrack 5 Wireless Penetration Testing Beginner's Guide (3rd ed.). Packt Publishing, 2011

5. Thomas Mathew, "Ethical Hacking", OSB publishers, 2003

13.4.10 Resolved to approve the reduction in intake of certain programs as listed in the following table from the academic year 2021-2022 onwards.

S.No	Courses	Existing Intake	New Intake
UG			
1	B.E. Automobile Engineering	60	30
2	B.Tech. Chemical Engineering	120	90
3	B.E. Civil Engineering	60	30
4	B.E. Marine Engineering	60	30
PG			
5	M.E. Communication Systems	25	12
6	M.E. Computer Science and Engineering	25	12
7	M.E Computer Science and Engineering (Networks)	18	12
8	M.E. Mechatronics	18	12
9	M.E. Power Electronics and Drives	25	12

13.4.11 Resolved to approve the amendments in the curriculum of various engineering programs as follows:

A. _Board of Mechanical and Automobile Engineering_

❖ **Resolved to approve a new Professional Elective course "Control Systems for Mechanical Engineering" in the curriculum of B.E. Mechanical Engineering under R2018**

❖ **Resolved to approve following certificate courses to be offered by the departments of Mechanical and Automobile Engineering.**

S.No	Name of the certificate course	Associating Company
1	Gear Design and Manufacturing	Bonfiglioli

2	Additive Manufacturing using 3D Printing	AMUSE / FALCON 3D
3	Robotics /AI/ ML	Prag Robotics
4	Geometric Dimensioning and Tolerance	Tespa Tools
5	Data Analytics in Manufacturing	TVS Training Centre
6	Green Belt in Manufacturing	TVS Training Centre
7	CNC Programming	ACE Micromatic / Fanuc
8	Battery Optimization for Hybrid and Electric Vehicle	Self
9	Advanced Welding Technology	Fronius
10	Fundamentals of Vehicle Dynamics Using MATLAB	Self
11	Competency Improvement Program on Electric and Hybrid Vehicle Engineering	Haritha TechLogix

B. _Board of Biotechnology and Chemical Engineering_

❖ **_Resolved to amend the syllabus of CH18704 Process Equipment design. The new syllabus is given below._**

CH18704	PROCESS EQUIPMENT DESIGN – II	L	T	P	C
		3	1	0	4

OBJECTIVES:
To impart the basic knowledge on the process and mechanical design of process Equipments

UNIT I   GENERAL DESIGN CONSIDERATIONS   12
General Introduction, Stress created due to static and dynamic loads, design stress, elastic instability, combined stress and theories of failures, fatigue, brittle fracture, creep, temperature effects, radiation effect, effect of fabrication methods.

UNIT II   PRESSURE VESSELS   15
Codes & Standards, selection of material, vessels operating at low temperatures and elevated temperatures, design conditions and stress, design of shell and its components, supports, stress from local loads and thermal gradients, thermal stresses in cylindrical shell. Features of high pressure vessels – solid walled vessel, vessel closures, jackets.

UNIT III   STORAGE VESSELS   12
Codes & Standards, Storage of fluids: storage of non-volatile fluids, storage of volatile fluids, storage of gases, design of rectangular tanks, design of tanks, nozzles and mountings, large capacity storage tanks

UNIT IV   MECHANICAL FIXTURES AND SUPPORTS   9

Vessel support: Saddle supports, skirt supports, bracket supports. Bolted flanged joints: Type of flanges and its selection, gaskets, flange faces, flange design, standard flanges.

UNIT V   COMMON INDUSTRIAL EQUIPMENT DESIGN   1
Design of Cyclone Separator, Filter, Thickener.

TOTAL Hours : 60

OUTCOMES:
- To impart the basics of mechanical design considerations.
- To study the mechanical design of Pressure vessels.
- To understand the mechanical design of storage vessel.
- To gain knowledge on mechanical design of mechanical fixtures and supports.
- To appraise the industrial design practices of common equipments.

TEXTBOOKS:
1.   J.M.Coulson, J.Richardson, "Chemical Engineering", Vol. 6, Asian Books Printers, Fourt edition 2005.
2.   M.V. Joshi, V.V. Mahajan, "Design of Process Equipment Design", Thirs edition, McMilla India, 1996.

REFERENCES:
1.   Indian Standard Specifications IS-803, 1962; IS-4072, 1967; IS-2825, Indian Standards Institution, New Delhi. 1969
2.   R.H.Perry,"Chemical Engineers Handbook", Seventh Edition, McGrawHill, 2004.
3.   Suresh C.Maidargi ,"Chemical Process Equipment Design & Drawing, Volume 1, PH Learning Ltd., 2015.
4.   Brownell and Young, "Process Vessel Design", Wiley Eastern, 2009.
5.   Ray Sinnott, Gavin Towler, Chemical Engineering Design - Principles, Practice an Economics of Plant and Process Design, Butterworth-Heinemann, 2007.

Resolved to approve the following certificate course to be offered in Chemical Engineering department

> 1. *Matlab for Engineers*

Resolved to approve the following Value added courses to be offered in Biotechnology department

> 1. *Genomic Data Analytics in Biotechnology*
> 2. *Synthetic Biology*

> C.   *Board of Civil Engineering*
>
> *Resolved to approve to include the following new courses and its syllabus*

S.No.	Course Code	Course Title
Professional Electives		
1.	CE18033	Geo synthetics Design and Applications
2.	CE18034	Finite Element Analysis
3.	CE18035	Deep Foundation
Open Electives		
1.	OE18408	Water Pollution and its Management
Value Added Courses		
1.	VD18415	Biomimicry in Civil Engineering
2.	VD18416	Architectural Acoustics
3.	VD18417	Forensic Civil Engineering
4.	VD18418	Optimization Techniques
5.	VD18419	In-Situ Soil Testing and Instrumentation
6.	VD18420	Non Destructive Testing Techniques
7.	VD18421	Base Isolation and Damping Techniques in Aseismic Design

CE18033	GEOSYNTHETICS DESIGN AND APPLICATIONS	L	T	P	C
		3	0	0	3

OBJECTIVES:
- To know the design and applications of geosynthetics

**UNIT I   OVERVIEW OF GEOSYNTHETICS AND   9
              GEOTEXTILES**
An overview on the development and applications various geosynthetics - the geotextiles, geogrids, geonets, geomembranes and geocomposites. Designing with geotextiles: Geotextile properties and test methods – functions - Designing for separation, reinforcement, stabilization, filtration, drainage.

UNIT II   GEOGRIDS   9
Geogrid properties and test methods – physical properties, mechanical properties, endurance properties and environmental properties – Designing for grid reinforcement and bearing capacity.

UNIT III   GEONETS   9
Geonet properties and test methods – Physical properties, mechanical properties, hydraulic properties, endurance properties and environmental properties -Designing geonet for drainage.

UNIT IV   GEOMEMBRANES   9
Geomembrane properties and test methods – physical properties, mechanical properties,

chemical properties and biological hazard - Applications for geomembranes.

UNIT V   GEOCOMPOSITES   9
Geocomposites in separation, reinforcement – reinforced geotextile composites – reinforced geomembrane composites – reinforced soil composites using discontinuous fibres and meshes, continuous fibres and three –dimensional cells, geocomposites in drainage and filtration.

TOTAL PERIODS :45

COURSE OUTCOMES:
After successful completion of this course, the students will be able to
- Describe the properties, test methods and applications of geotextiles
- Describe the properties, test methods and applications of geogrids
- Describe the properties, test methods and applications of geonets
- Describe the properties, test methods and applications of geomembranes
- Describe the properties, test methods and applications of geocomposites

TEXT BOOKS:
1. Sivakumar Babu G.L. "An Introduction to Soil Reinforcement and Geosynthetics" University Press, 2005.
2. Koerner, R.M. – "Designing with geosynthetics", Pearson Education Inc., 2005.

REFERENCES:
3. Rao, G.V. – "Geosynthetics – an Introduction", Sai Master Geoenvironmental Services Pvt. Ltd. Hyderabad, 2011.
4. Shukla, "Fundamentals of Geosynthetic Engg. Imperial College Press, London, 2006.

CE18034	FINITE ELEMENT ANALYSIS	L	T	P	C
		3	0	0	3

OBJECTIVES:
- To introduce the concepts of Mathematical Modeling of Engineering Problems.
- To appreciate the use of FEM to a range of Engineering Problems.

UNIT I   BASICS OF FINITE ELEMENT ANALYSIS   9
Historical Background – Mathematical Modeling of field problems in Engineering – Governing Equations – Discrete and continuous models – Boundary, Initial and Eigen Value problems– Weighted Residual Methods – Variational Formulation of Boundary Value Problems – Ritz Technique – Basic concepts of the Finite Element Method

UNIT II   ONE DIMENSIONAL PROBLEMS   9
One Dimensional Second Order Equations – Discretization – Element types- Linear and Higher order Elements – Derivation of Shape functions and Stiffness matrices and force vectors- Assembly of Matrices – Solution of problems for beam, bar and truss, heat transfer.

UNIT III   TWO DIMENSIONAL SCALAR VARIABLE   9
**   PROBLEMS**
Second Order 2D Equations involving Scalar Variable Functions – Variational

formulation –Finite Element formulation – Triangular elements – Shape functions and element matrices and vectors. Application to Field Problems – Thermal problems – Quadrilateral elements – Higher Order Elements.

UNIT IV   TWO DIMENSIONAL VECTOR VARIABLE   9
**   PROBLEMS**
Equations of elasticity – Plane stress, plane strain and axisymmetric problems – Body forces and temperature effects – Stress calculations – Plate and shell elements

UNIT V   ISOPARAMETRIC FORMULATION   9
Natural co-ordinate systems – Isoparametric elements – Shape functions for iso parametric elements – One and two dimensions – Serendipity elements – Numerical integration and application to plane stress problems – Matrix solution techniques – Solutions Techniques to Dynamic problems – Introduction to Analysis Software

TOTAL PERIODS :45

COURSE OUTCOMES:
After successful completion of this course, the students will be able to
- Summarize the basics of finite element formulation.
- Apply finite element formulations to solve one dimensional Problems.
- Apply finite element formulations to solve two dimensional scalar Problems.
- Apply finite element method to solve two dimensional Vector problems.
- Apply finite element method to solve problems on iso parametric element and dynamic Problems.

TEXT BOOKS:
1. Reddy. J.N., "An Introduction to the Finite Element Method", 3rd Edition, Tata McGraw-Hill, 2005
2. Seshu, P, "Text Book of Finite Element Analysis", Prentice-Hall of India Pvt. Ltd., New Delhi, 2007.

REFERENCES:
1. Bathe, K.J. and Wilson, E.L., "Numerical Methods in Finite Elements Analysis", Prentice Hall of India, 1985.
2. Krishnamurthy, C.S., "Finite Element Analysis", Tata McGraw Hill, 2000.
3. Rao. S.S., "Finite Element Methods in Engineering," Butterworth and Heinemann, 2001.

CE18035	DEEP FOUNDATION	L	T	P	C
		3	0	0	3

OBJECTIVES:
- To study about the principles and design of deep foundations.

UNIT I   PILE CLASSIFICATIONS AND LOAD TRANSFER   9
**   PRINCIPLE**
Necessity of pile foundation – classification of piles – factors governing choice of type of pile – load transfer mechanism – piling equipments and methods – effect of pile installation on soil condition – pile raft system – basic interactive analysis - criteria for

pile socketing – responsibility of engineer and contractor.

UNIT II   **AXIAL LOAD CAPACITY OF PILES AND PILE**   **9**
                GROUPS

Allowable load of piles and pile groups – Static and dynamic methods – for cohesive and cohesionless soil – negative skin friction – group efficiency – pile driving formulae – limitation – Wave equation application – evaluation of axial load capacity from field test results – pile integrity test – Settlement of piles and pile group – IS codal provisions and IRC guide lines.

UNIT III   **LATERAL AND UPLIFT LOAD CAPACITIES OF**   **9**
                PILES

Piles under Lateral loads – Broms method, elastic, p-y curve analyses – Batter piles – response to moment – piles under uplift loads – under reamed piles – Drilled shaft – Lateral and pull out load tests – piled-raft design philosophy - IS codal provision – IRC and API guide lines – case studies.

UNIT IV   **STRUCTURAL DESIGN OF PILE AND PILE**   **9**
                GROUPS

Structural design of pile – structural capacity – pile and pile cap connection – pile cap design – shape, depth, assessment and amount of steel – truss and bending theory- Reinforcement details of pile and pile caps — pile subjected to vibration – IS codal provision – IRC guide line.

UNIT V   **CAISSONS**   **9**

Necessity of caisson – type and shape - Stability of caissons – principles of analysis and design - tilting of caisson – construction - seismic influences - IS codal provision.

TOTAL PERIODS :45

COURSE OUTCOMES:
After successful completion of this course, the students will be able to
- Describe the importance of pile foundation and its various functions
- Arrive the vertical load carrying capacity of pile and pile group
- Arrive the lateral load carrying capacity of pile and pile group
- Design the pile a pile caps considering all possible loads
- Describe about the caisson foundation and its stability

TEXT BOOKS:
1 Varghese P.C.,” Foundation Engineering”, PHI Learning Private Limited, New Delhi, 2005.
2 Varghese P.C.,” Design of Reinforced Concrete Foundations”, PHI Learning Private Limited, New Delhi, 2009.

REFERENCES:
1 Bowles, J.E., Foundation Analysis and Design, Fifth Edition, McGraw Hill, New York, 1996.
2 Donald, P., Coduto, Foundation Design Principles and Practices, Prentice Hall, Inc. Englewood Cliffs, New Jersey, 1996.

3 Michael Tomlinson and John Woodward, Pile design and construction practice, Taylor & Francis Group, London & New York, 2008.

4 Das, B.M., Principles of Foundation Engineering, Design and Construction, Fourth Edition, PWS Publishing, 1999

5 Poulos, H.G., Davis, E.H., Pile foundation analysis and design, John Wiley and Sons, New York, 1980.

6 Tomlinson, M.J. Foundation engineering, ELBS, Longman Group, U.K. Ltd., England 1995.

OE18408	WATER POLLUTION AND ITS MANAGEMENT	L	T	P	C
		3	0	0	3

OBJECTIVES:
- To know the basics, importance of Water Pollution
- To study the various Effects of Water pollution
- To learn the importance of methods of control of Water Pollution
- To understand the various Water Pollution control Act

UNIT I   SOURCES & CHARACTERISTICS OF WATER POLLUTION   9

Water Pollution-Sources & types of water pollution –Physical, chemical & biological – Effect of water pollution. Drinking water quality standards waste Water treatment – Primary, secondary, tertiary-water pollution prevention & control act – 1974.

UNIT II   WATER QUALITY AND STANDARDS   9

Quality of surface waters, Water quality in flowing waters, Water quality in impounded waters, Groundwater quality, Water quality standard Microbiological quality of drinking water, and Chemical quality of drinking water.

UNIT III   INDUSTRIAL ACTIVITY & MITIGATION MEASURES   9

Role of water in different industries-Effluent discharge characteristics-Discharge Standards for Rivers and Streams-Role of stakeholders, Public NGOS, Government 58 Open Electives-Engg&Tech-SRM-2013 in Protection of Water bodies-Control Measures-Mitigation Measures for Industrial Water Contamination due to industries.

UNIT IV   WATER POLLUTION REGULATIONS   9

Administrative regulation under recent legislations in water pollution control. Water (Prevention & control of pollution) Act 1974 as amended by Amendment Act 1988. Water (Prevention & control of pollution) Rules 1975 Water (Prevention & control of pollution) Cess Act. 1977 as amended by Amendment Act 1991.

UNIT V   ROLE OF REGULATORY BOARDS   9

Sustainable Development, Rain Water Harvesting-Methods-Water Pollution-Causes and Effects-Role of Regulatory bodies and Local bodies-CPCB-TWAD Board – CMWSSB – Case studies related to Effective Water Management.

TOTAL PERIODS :45

COURSE OUTCOMES:
After successful completion of this course, the students will be able to
- Ennumerate the sources and characteristics of water pollution.
- Describe the water quality standards
- Summarise the industrial activity and mitigation measures
- Summarise thewater pollution regulations
- Describe the role of regulatory bodies

TEXT BOOKS:
1. Fair.G.M, "Water and Waste water engineering Vol.I & II" .John Wiley and sons, Newyork. 2010.
2. P.C. Bansil, "Water Management In India,"Concept Publishing Company", New Delhi, 2004.

REFERENCES:
1. Metcalf & Eddy, "Wastewater engineering, Treatment and Reuse", Tata Mac Grawhill publications, 2008.
2. Eckenfelder, W.W., "Industrial Water Pollution Control", McGraw-Hill, 2009.
3. Arceivala.S.J, "Wastewater Treatment for Pollution Control", Tata McGraw- Hill, 2008.
4. Aruna Venkat, "Environmental Law and Policy", PHI learning private limited New Delhi, 2011.

VD18415	BIOMIMICRY IN CIVIL ENGINEERING	L	T	P	C
		2	0	0	2

OBJECTIVES:
- Understand the principles of biomimetics and how to adopt biomimicry in civil engineering.

SYLLABUS:

Introduction to biomimetics, evolution and approach towards biomimicry, biomimicry – a sustainable design, applications in construction materials, paint (lotus concept), architectural design of buildings and bridges, water harvesting, passive cooling systems, self-healing buildings, examples of buildings inspired by nature.

COURSE OUTCOMES:

After successful completion of this course, the students will be able to
- Summarise the concepts and applications of biomimicry in civil engineering.

TEXT BOOKS:
1. Pacheo Torgal,F., Labrincha, J.A., Diamanti, M.V., Yu, C.P., Lee, H.K., "Biotechnologies and biomimetics for Civil Engineering", Springer, 2015.
2. Akhlesh Lakhtakia ,Raúl José Martín-Palma , "Engineered Biomimicry", Elsevier , 1st Edition, 2013

REFERENCES:
1. Peter Forbes, "The Gecko's Foot: Bio-inspiration: Engineering New Materials from Nature", W. W. Norton & Company , May 17, 2006
2.

VD18416	ARCHITECTURAL ACOUSTICS	L	T	P	C
		2	0	0	2

OBJECTIVES:
- To understand basic concepts of acoustics and human hearing, behavior of sound in enclosed spaces, the theories on architectural acoustics, and the basic principles of noise control and acoustic comfort in buildings.

SYLLABUS:

Introduction to acoustics, effects of noise, basic principles of sound – Acoustical dry wall systems and panels – Room acoustics – absorption, reflection, refraction and diffusion – Building acoustics – noise control applications – hearing and perception – non-acoustic spaces – auditorium acoustics – acoustical measurement, analyses and modeling – Regulations and guidelines

COURSE OUTCOMES:
After successful completion of this course, the students will be able to
- Describe the principles of acoustical design of buildings

TEXT BOOKS:
1. Marshall Long, "Architectural Acoustics", Academic Press, 2nd Edition, March 2014.
2. Tor Erik Vigran, "Building Acoustics", CRC Press, 1st Edition, July 2008.

REFERENCES:
1. M.D. Egan, "Architectural Acoustics,', Mc Grawhill Inc., 1988.
2. John Edwin Moore, "Design for Good Acoustics and Noise Control", Macmillan Education, 1988.
3. M. D. Egan, "Concepts in Architectural Acoustics", Tulane University, School of Architecture, 1972.
4. J. Flynn, J. A. Kremers, A. W. Segil, G. Steffy, Van Nostrand Reinhold, "Architectural Interior Systems, Lighting, Acoustics, Air Conditioning",Van Nostrand Reinhold , 1992.

VD18417   **FORENSIC CIVIL ENGINEERING**   **L   T   P   C**
                                                              2   0   0   2

OBJECTIVES:
To introduce the various aspects of investigation involved in Failure of structures

SYLLABUS:

Testing of failures - Various methods of testing of failed structures - Laser scanning, microscope, Radio graphic evaluation, Load Testing of shoring systems and repair technology. Structural Failures - Failure of construction materials steel, concrete - Joints by Bolt and weld. Failure of compression members and tension members by reversal of loads – Failure aspects of post tensioned concrete systems, space frame, plane frame, precast buildings, failure of bridges. Geo Technical Failures - Soil liquefaction, failure of foundation systems – Causes and prevention. Designing Against Failure - Quality control – Material selection, workmanship, design and detailing. Case Studies And Professional Practice - Case Studies on famous failures – Reasons and lessons learnt – Aspects of professional practice.

COURSE OUTCOMES:

After successful completion of this course, the students will be able to
- Summarize the different failures encountered in civil engineering practice.

TEXT BOOKS:
1. Robert Ratay, "Forensic Structural Engineering Handbook", McGraw-Hill Education, 2nd Edition, 2010.
2. Stephen E. Petty, "Forensic Engineering – Damage Assessments for Residential and Commercial Structures", CRC Press, 1st Edition, 2013.

REFERENCES:
1. "Forensic Engineering – 2012", proceedings of sixth ASCE Conference of Forensic Engineering held in San Francisco, California, Oct 31- Nov 03, 2013.

VD18418   **OPTIMIZATION TECHNIQUES**   **L   T   P   C**
                                                          2   0   0   2

OBJECTIVES:
To introduce the various optimization techniques.

SYLLABUS:

Formulation of a LPP – Graphical Method – Simplex method – duality – dual simplex method – sensitivity analysis, transportation and assignment problems, traveling salesman problem – Lagrange multipliers and Kuhn-Tucker conditions – Quadratic programming problem – Dynamic Programming – Integer Linear Programming.

COURSE OUTCOMES:

After successful completion of this course, the students will be able to
- Apply optimization techniques for simple problems

TEXT BOOKS:
1. Singiresu S Rao, "Engineering Optimization – Theory and Practice", New Age International Publishers, 2013.
2. A.K. Malik, S.K. Yadav and S.R. Yadav, "Optimization Techniques", IK Publishers, 2013.

REFERENCES:
1. J.C. Pant, Introduction to Optimization, Jain Brothers, 2008.
2. S.S. Rao, Optimization Theory and Applications, Wiley Eastern, 2004.
3. K.V. Mittal, Optimization Methods, Wiley Eastern, 2003.
4. H.A. Taha, Operations Research, Pearson, 2007.

VD18419	IN-SITU SOIL TESTING AND INSTRUMENTATION	L	T	P	C
		2	0	0	2

OBJECTIVES:
- To understand the various parameters to be arrived from field test
- To interpret the required properties of soil for designing structural elements

SYLLABUS:

Procedure, limitations, correction and data interpretation of following methods - Field index property tests - Penetration tests - Field vane shear test (In-situ shear and borehole shear test) – Pressure meter test – Dilatometer test – Plate load test (Monotonic and cyclic) – Field permeability tests – Block vibration test
Instrumentation in soil engineering –Data acquisition system – Strain gauges – Load cells – Earth pressure cells – Settlement and heave gauges – Pore pressure measurements - Slope indicators

TEXT BOOKS:
1. Alam Singh and Chowdhary, G.R., Soil Engineering in Theory and Practice, Volume-2, Geotechnical testing and instrumentation, CBS Publishers and Distributors, New Delhi,2006.
2. Nair, R.J. and Wood, P.M., Pressuremeter Testing Methods and Interpretation, Butterworths, 1987.

REFERENCES:
1. Dunnicliff, J., and Green, G.E., Geotechnical Instrumentation for Monitoring Field Performance, John Wiley, 1993.
2. Hunt, R.E., Geotechnical Engineering Investigation Manual, McGraw Hill,1984.
3. Hanna, T.H., Field Instrumentation in Geotechnical Engineering, Trans Tech., 1985.
4. Day, R.N., Geotechnical and Foundation Engineering, Design and Construction, McGraw-Hill, 1999.

5. Bowles, J.E., Foundation Analysis and Design, Fifth Edition, The McGraw-Hill companies, Inc., New York, 1995.
6. Clayton C. R. I., Matthews M. C. and Simons N. E., Site Investigation, Second Edition Halsted Press, 1982.

VD18420	NON-DESTRUCTIVE TESTING TECHNIQUES	L	T	P	C
		2	0	0	2

OBJECTIVES:
To introduce the various Non - destructive testing techniques.

SYLLABUS:

Introduction to Destructive, semi-destructive & Non-destructive testing methodology, Importance of Non-Destructive evaluation - Problems faced during Non-destructive evaluation, Non-Destructive testing of concrete - Visual investigation- Hardness methods- Rebound Hammer test -Acoustical emission methods- Radar method NDT for corrosion assessment- Concrete behavior under corrosion, disintegrated mechanisms- moisture effects and thermal effects –Corrosion activity measurement- chloride content – Depth of carbonation, Carbonation test - Impact echo methods- Ultrasound pulse velocity methods- Pull out tests. Half-cell potentiometer test, Core test and relevant provisions of I.S. codes. Practical applications and advances in NDT.

Case studies - NDT for detection of cracks voids in concrete bridges, NDT for steel bridges (Ultrasonic Testing, Magnetic and Liquid Penetrant Testing), NDT on masonry bridges
.
COURSE OUTCOMES:

After successful completion of this course, the students will be able to
- Summarize the different Non-destructive testing techniques.

TEXT BOOKS:
1. Malhotra, V.M. and Carino, N.J., Handbook on Non-Destructive Testing of Concrete, 2nd Ed., Taylor and Francis, London.
2. Bungey, S., Lillard, G. and Grantham, M.G. Testing of Concrete in Structures, 4th Ed. Taylor and Francis, London

REFERENCES:
1. Krautkramer, H., Ultrasonic Testing of Materials, Springer-Verlag, 1969.
2. Novgoresky, M.A., Testing of Building Materials and Structures, Mir Publishers, 1973.
3. American Society of Metals: Handbook, Vol. II, Destructive Inspection and Quality Control, 1976

VD18421	**BASE ISOLATION AND DAMPING TECHNIQUES IN ASEISMIC DESIGN**	**L**	**T**	**P**	**C**
		2	**0**	**0**	**2**

OBJECTIVES:

This course is designed to give an insight into the conventional techniques and latest developments regarding base isolation and damping techniques in aseismic design of civil engineering structures.

SYLLABUS:

Base isolation Techniques – Need – Mechanism – Types – Laminated Rubber bearing – Lead core rubber bearing – Roller Pendulum system (RPS) – Seismic dampers – Types – Metallic dampers- friction dampers – viscous fluid dampers – Semi-active dampers - Magneto-rheological Fluid dampers for vibration control - RPS augmented with Magneto-rheological fluid dampers for seismic isolation – Magneto-rheological elastomers and gels for seismic isolation – Shape memory alloys for vibration control – Design guidelines for base isolation.

COURSE OUTCOMES:

After successful completion of this course, the students will be able to
- Analyze the conventional and smart techniques for seismic isolation.
- Analyze the conventional and smart techniques for damping of structures

REFERENCES:
1. Anil K. Chopra, "Dynamics of Structures – Theory and applications to Earthquake Engineering", Pearson Education, 2019
2. Kelly T.E., "Bas Isolation of Structures – Design guidelines", Holmes consulting Group ltd., 2001.
3. Kelly T.E., "In-Structure Damping and energy dissipation", Holmes consulting group ltd., 2001.
4. S.R. Damodarasamy & S. Kavitha, " Basics of structural Dynamics and Aseismic design", PHI Learing private Limited, New Delhi, 2012.
5. A.V. Srinivasan & D. Michael McFarland, " Smart Structures –Analysis and Design", Cambridge University Press, 2001

Resolved to approve the following certificate courses to be offered by the department of civil Engineering.

Certificate Courses	
Course Name	**Associating Company**
Interior and Exterior Design using Sketch-up and V-ray Software	Sarva Sudarsana Academy, Chennai
Travel Behaviour Analysis	Self
Project Planning and Scheduling Using Primavera P6	Self

D.   _Board of Computer science and Information technology_

❖ *Resolved to include a new Professional Elective "Block chain for Business", framed by Infosys in the curriculum of B. E - CSE and B. Tech- IT under Regulations 2018*

❖ *Resolved to adopt the changes in the evaluation pattern for the subject "OE18004: Ethical Hacking and IT Security" with 40 marks for theory and 60 marks for practical.*
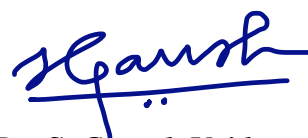
E.   _Board of Marine engineering_

❖ *Resolved to approve the new certificate course on Advanced welding process.*

F.   _Board of Science and humanities._

❖ *Resolved to approve the new certificate course on Basics of Quantum Mechanics in the Applied Physics department*

❖ *Resolved to approve to include "Biology for Engineers as a Basic science course in the new curriculum.*

❖ *Resolved to approve to include Technical Tamil or Tamil in Technology as open elective in the curriculum R2018*

The Chairman concluded the Academic Council meeting as no further points for discussion by thanking all the members for their participation.

(Dr. S. Ganesh Vaidyanathan)
Chairman/ Academic Council - SVCE