DPU

Dr. D. Y. PATIL VIDYAPEETH, PUNE

(Deemed to be University)

Syllabus for B. Tech. Artificial Intelligence (AI) and Data Science

(2023-24)

First, Second & Third Year

INDEX

REGULATION FOR THE UNDERGRADUATE DEGREE PROGRAMB. TECH. ARTIFICIAL INTELLIGENCE (AI) AND DATA SCIENCE BTAI (2023-24)

1. **Eligibility**
   - The Candidate should be an Indian National
   - Passed 10+2 examination with Physics/ Mathematics / Chemistry/ Computer Science/ Electronics/ Information Technology/ Biology/ Informatics Practices/ Biotechnology/ Technical Vocational subject/ Agriculture/ Engineering Graphics/ Business Studies/ Entrepreneurship as per table1.3(a) Agriculture stream (for Agriculture Engineering) Obtained at least 50% marks (45% marks in case of candidates belonging to reserved category) in the above subjects taken together.

   - Good Scores in any one of the following entrance exams: All India Level B. Tech. Artificial Intelligence (AI) and Data Science DPU Engineering Entrance Exam (AIBTAIET) or JEE (Main) or Any State Government Engineering Entrance Examination.

2. **Provision of Lateral Entry**
   Passed min. 3 years Diploma examination with at least 50% marks (45% marks in case of candidates belonging to reserved category subject to vacancies in the First Year, in case the vacancies at lateral entry are exhausted.
   (The Universities will offer suitable bridge courses such as Mathematics, Physics, Engineering drawing, etc., for the students coming from diverse backgrounds to prepare Level playing field and desired learning outcomes of the programme).

3. **Duration of the course**
   The B. Tech undergraduate degree program is of four years (Total Eight semesters) degree program.
   Duration of the course: 4 years i.e. 8 semesters.
   Semesters - An academic year consists of two semesters
   Odd Semester: June/July to November/December
   Even Semester: November/December to April/May

4. **Medium of instruction:**
   English shall be the medium of instruction for all the subjects of study and for examination of the course.

5.Attendance:
A candidate has to secure minimum-
1. 75% attendance in theory
2.80% in practical for qualifying to appear for the final examination.

6. Scheme of Examination

(a) Internal Examinations (Theory + Practical + Project)

1. There shall be two internal examinations (also called internal assessment tests I and II) of one hour duration for each course to be held as per the schedule fixed in the Academic Calendar.

2. A student can take for supplementary re-internal exam of a specific subject or all the subjects for the betterment of performance in case of scoring of less mark in previous internal assessment exams only after successful submission of an application to the class teacher which will be approved by Director/Principal of the institute.

3. A student has to do Project Based Learnings from the first year of their engineering, at the end of the degree program i.e. to the final year of engineering student has to perform the real life problem statement project in a group of 3 to 5 students.

b). University Examination

University Theory Examination Pattern		
Section A		
MCQs	15 x 1 Mark each	15 Marks
Section B		
Short Questions (Any 5 out of 8)	05 x 3 Marks each	15 Marks
Long answer Questions(Any 2 out 3)	02 * 5 Marks each	10 Marks
Section C		
Long answer Questions (Any 2out of 3)	02 x 10 Marks each	20 Marks
	Total	**60 Marks**

(c) EVALUATION SCHEME (THEORY)

Examination Duration Marks

I Internal 45 minutes 20

II Internal 30 minutes 15

Attendance 5

End Semester 2 hours 30 minutes 60

Total 100

PRACTICAL EVALUATION SCHEME

Examination Marks

Practical Internal (Continuous) assessment: 40

End semester examination: 60

Total: 100

Standard of Passing:

1. The standard of passing shall be minimum 50% in each subject.
2. The marks of all heads combined (University Theory Exam + Internal Assessment Theory + Practical / Viva) shall be considered together for Passing of the candidate.

(d) Grace Marks

The grace marks up to a maximum of 1 percentage of total marks may be awarded to a student who has failed in not more than two subjects in the respective semester. Provided that these grace marks shall be awarded only if the student passes after awarding these marks.

(e) Grading System

UGC 10-point Grading Scale

Marks	Letter Grade	Grade Point
90 To 100	**O** : Outstanding	10
80 To 89	**A+** : Excellent	9
70 To 79	**A** : Very Good	8
60 To 69	**B+** : Good	7
55 To 59	**B** : Average	6
50 To 54	**P** : Pass	5
00 To 49	**F** : Fail	0
-	**AB** : Absent	0

Computation of SGPA and CGPA

The UGC recommends the following procedure to compute the Semester Grade Point Average (SGPA) and Cumulative Grade Point Average (CGPA):

i. The SGPA is the ratio of sum of the product of the number of credits with the grade points scored by a student in all the courses taken by a student and the sum of the number of credits of all the courses undergone by a student, i.e.
SGPA (Si) = Σ(Ci x Gi) / ΣCi
where Ci is the number of credits of the course and Gi is the grade point scored by the student in the course.

ii. The CGPA is also calculated in the same manner taking into account all the courses undergone by a student over all the semesters of a programme, i.e.
CGPA = Σ(Ci x Si) / Σ Ci where Si is the SGPA of the semester and Ci is the total number of credits in that semester.

iii. The SGPA and CGPA shall be rounded off to 2 decimal points and reported in the transcripts.
Illustration of Computation of SGPA and CGPA and Format for Transcripts

i. Computation of SGPA and CGPA

Illustration for SGPA

Course	Credit	Grade letter	Grade point	Credit Point (Credit x Grade
Course 1	**3**	**A**	8	3 X 8 = 24
Course 2	**4**	B+	7	4 X 7 = 28
Course 3	**3**	B	6	3 X 6 = 18
Course 4	**3**	O	10	3 X 10 = 30
Course 5	**3**	C	5	3 X 5 = 15
Course 6	**4**	B	6	4 X 6 = 24
	20			**139**

Thus, SGPA =139/20 =6.95

Illustration for CGPA

semester 1	semester 2	semester 3	semester 4	semester 5	semester 6
credit : 20 sgpa : 6.9	credit : 22 sgpa : 7.8	credit : 25 sgpa : 5.6	credit : 26 sgpa : 6.0	credit : 26 sgpa : 6.3	credit : 25 sgpa : 8.0

Thus, CGPA = 20 x 6.9 + 22 x 7.8 + 25 x 5.6 + 26 x 6.0 + 26 x 6.3 + 25 x 8.0 = 6.73 144

ii. Transcript (Format): Based on the above recommendations on Letter grades, grade points and SGPA and CGPA, the Institute may issue the transcript for each semester and a consolidated transcript indicating the performance in all semesters.

(f) ATKT (Allowed-to-keep-terms)

1. A Student who has failed in 3 subjects with 2 practical in respective academic year (Both Semesters combined) shall be allowed to keep term for next Semester respectively.

2. A student who failed more than 3 subjects in whole academic year cannot be promoted to next academic year.

3. For enrolment in third year of B. Tech Engineering program, a student must pass the university examinations of 1st & 2nd semesters of first year B. Tech , and a student from second year B. Tech Engineering program can be promoted to third year B. Tech Engineering program with not more than 3 subjects of second year B.Tech Engineering program (Both Semesters combined) as a backlog.

(i) Criteria for appointment of Examiner (Internal & External) andterms of their appointment.

1. Adhoc Board of Studies of Computer Science and Engineering shall submit, to the Committee constituted by Board of Examinations, a panel of examiner names, along with their addresses, suitable for appointment as Internal and External Examiners.

2. Examiners shall be appointed by the Academic Council as per section 8(b) (viii) of the Rules of Dr. D. Y. Patil University on the recommendations of the Board of Examinations.

3. In case of refusal from the person so appointed, the Controller of Examinations shall appoint substitute examiners from the panel approved.

4. Internal and External Examiners: An "Internal Examiner" means a person who is a teacher in the constituent college(s) / institute(s) of the University. The teachers in other universities or recognized teacher of other University in the state or outside the state shall be referred to as the "External Examiner".

5. Intimation of appointment as the examiner shall be accompanied by a copy of the instructions/guidelines relating to the examination for he/she is appointed, as also the information regarding the remuneration he/she shall be entitled to draw, if he/she acts as examiner. He/ She is expected to attend to and shall be required to send to the Controller of Examinations.

6. Examiners shall be appointed for examinations to be held in that academic year; however they shall be eligible for reappointment.

7. Relatives, Close Friends or next to the kin which are directly or indirectly related to the candidates shall not to be included.

7. Eligibility Criteria for appearing the Entrance Test

a) The candidate should be an Indian National.
b) Minimum age: 17 years on or before 31st December 2023
c) The candidate must have either appeared at Higher Secondary Certificate (HSC / Std. XII) examination

OR

Passed 10+2 examination with Physics/ Mathematics / Chemistry/ Computer Science/ Electronics/ Information Technology/ Biology/ Informatics Practices/ Biotechnology/ Technical Vocational subject/ Agriculture/ Engineering Graphics/ Business Studies/ Entrepreneurship as per table1.3(a) Agriculture stream (for Agriculture Engineering) Obtained at least 50% marks (45% marks in case of candidates belonging to reserved category) in the above subjects taken together

OR

Passed min. 3 years Diploma examination with at least 50% marks (45% marks in case of candidates belonging to reserved category subject to vacancies in the First Year, in case the vacancies at lateral entry are exhausted.(The Universities will offer suitable bridge courses such as Mathematics, Physics, Engineering drawing, etc., for the students coming from diverse backgrounds to prepare Level playing field and desired learning outcomes of the programme).

8. Eligibility for NRI/PIO/FN

a) A candidate in any of these categories shall have completed 17 years of age on or before 31st December 2023.

b) He/she must have Physics, Chemistry, Maths and English (and desirably Biology or Life Sciences) at the CBSE, ISC, HSC or an equivalent examination.

c) In thecase of a student from any school that follows the American system of education, the candidate must have studied Physics, Chemistry and Mathematics, carrying 100 marks (25 marks each for Physics &Chemistry and 50 marks for Mathematic subject).

d) Maths (and desirably Biology) at AP'(Advanced Placement) level and must have minimum 'C' grade in these subjects. In the case of students passing Cambridge International Examination (CIE) the candidate should have passed Physics, Chemistry and Maths at "Advanced" level along with English at "Advanced Subsidiary" (AS) level.

*Note: Reservation will be as per directives of the Government of India, for universities established under Section 3 of UGC Act 1956 by Govt. of India, through the University Grants Commission as and when received.

9. General Category:

Admissions to this category shall be made on the basis of the merit of the candidates, who have qualified at the AIBTAIET-2023. NRI/PIO/FN Category: A candidate belonging to this category is not required to appear at the AIBTAIET-2023. However, he/she shall submit a separate application, in the prescribed form, available in the Vidyapeeth office and on the Vidyapeeth website. A committee, appointed by the competent authority for the purpose shall admit candidates on the basis of their inter se merit. The candidate will be required to pay a processing fee of US $ 200. In case any seat earmarked for NRI/PIO/FN is not filled in by the candidate(s) of any of these subcategories, the Management shall fill in such vacant seat(s) from the candidate(s) who has/have cleared the AIBTAIET-2023 and has/ have applied for the seat separately in the prescribed form available in the Vidyapeeth office and website.

10. Discipline & Code of Conduct:

10.1 Obligations of the Student

10.1.1 Conduct himself / herself properly

10.1.2 Maintain proper behavior.

10.1.3 Observe strict discipline both within the campus, hostel & outside of the Institution.

10.1.4 Ensure that no act of his / her consciously or unconsciously brings the Institution or any establishment or authority connected with it into disrespect.

10.2 Any act/s by the student which is contrary to the clause (1), shall constitute misconduct and/or indiscipline, which include any one or more of the acts jointly or severally, mentioned hereinafter;

10.2.1 Any act of the student which directly or indirectly causes or attempts to cause disturbance in the lawful functioning of the Institution.

10.2.2 The student who is repeatedly absent from the class, lectures, tutorials, practicals and other courses.

10.2.3 The student not abiding by the instructions of the Faculty members and not interacting with them with due respect.

10.2.4 Any student found misbehaving in the campus/class or behaving arrogantly, violently towards the faculty, staff or fellow student.

10.2.5 The Students who is not present for all the class tests, midterm tests, terminal and preliminary examinations.

10.2.6 Permitting or conniving with any person / parent / guardian, which is not authorized to occupy hostel room, residential quarter, or any other accommodation or any part thereof of the Institution.

10.2.7 Obstruction to any student or group of students in any legitimate activities, in classrooms / laboratories / field or places of social and cultural activities within the campus of the Institute.

10.2.8 Possessing or using any fire arms, lethal weapon, explosives, or dangerous substances in the premises of the Institution.

10.2.9 Indulging in any act which would cause embarrassment or annoyance to any student / authority / staff or any member of the staff.

10.2.10 Stealing or damaging any farm produce or any property belonging to the Institution, staff member or student.

10.2.11 Securing admission in the Institution, to any undergraduate or post graduate program or any other course by fabrication or suppression of facts or information.

10.2.12 If the student fails to complete the assignments regularly and has poor academic performance when assessed by the regular class teachers and internal assessment, he/she will not be allowed to appear for the Vidyapeeth examination.

10.2.13 If a student remains absent for lectures, practical or class test and examinations without prior permission of the principal or the head of the departments, she/he will not be compensated for extra class.

10.2.14 Students should read the notices regularly on notice boards in the academic complex, library and the department notice boards.

10.2.15 Damage of property of the college and its sister institutes like tampering with fixtures, fittings, equipment's, instruments, furniture, books, periodicals, walls, windows panels, vehicles etc., will be viewed very seriously.

10.2.16 Recording of any electronic images in the form of photographs, audio or video recording of any person without the person's knowledge; when such recording is likely to cause injury, distress, or damage the reputation of such person; is prohibited in any part of the College and hostel premises. The storing, sharing or distributing of such unauthorized records by any means is also prohibited.

10.2.17 Use of mobile phones and head phones during college hours is prohibited.

10.2.18 As per the rules and regulations of the Dr. D.Y. Patil Vidyapeeth, Pimpri, Pune, 80% attendance in a subject for appearing in the examination is compulsory inclusive of attendance in non-lecture teaching i.e. seminars, group discussion, tutorials, demonstrations, practical's, hospital (tertiary, secondary, primary) posting and bedside clinics etc.

10.2.19 The Students must present in proper dress code with apron/ lab coat, name badge and identity card on all week days/working days and during clinical duties.

10.2.20 Admission of the student will be cancelled at any point of time in case of;

10.2.20.1 Not submitting the required documents on time.

10.2.20.2 Failing to fulfil required eligibility criteria of the program.

10.2.20.3 Submission of fake or incorrect documents.

10.2.20.4 Admission gained by resorting to fraudulent means, illegal gratification or any unfair practice detected at any stage during the entire program.

10.2.20.5 Not paying the stipulated fees on time.

11. Attendance & Progress:

Each student shall always maintain decency, decorum and good conduct, besides keeping steady progress and require attendance. The conduct/ academic performance/ attendance of each student shall be reviewed periodically and appropriate action, including detaining from appearing for the Vidyapeeth Exam/ expelling from the Hostel or College, as the case may be, will be taken against the erring student. The students shall abide by such decision of the authorities of the Institution/Vidyapeeth.

12 Payment of Tuition and other Fees

12.1 On admission of candidates to the first year of the course of study, all the notified fees viz., annual tuition fee, registration and eligibility fee, health insurance, caution deposit, hostel and mess fee, etc., as applicable, should be paid on or before the prescribed date without fail. Any delay will attract penalty as specified. If any candidate fails to remit tuition fee and other fees within the last date as notified, he/she will forfeit his/her admission to the course concerned.

12.2 In respect of subsequent year(s) of study, tuition fee and other specified fees shall be paid on or before the date as notified to the parents/students and on the Notice Board of the Institution/College concerned. Late payment, if any, will attract penalty as specified.

12.3 Similarly, examination fee, as prescribed and notified from time to time, shall be paid on or before the due date. If there is any delay, student has to pay penalty as specified. If any student fails to remit the examination fee even after lapse of the period specified for payment with penalty, such student will not be issued Hall Ticket for the Vidyapeeth examination (s) / debarred from appearing in the Vidyapeeth examination (s).

12.4 All fees, once paid to the Vidyapeeth account, will not be refunded or adjusted for any other purpose under any circumstances.

13. Rules relating to Vidyapeeth examinations:

13.1 The candidates appearing for the Vidyapeeth theory examinations shall be under the direct disciplinary control of the Centre-in-charge. Possessionof cell phone or any electronic device or incriminatory materials by a candidate or found copying from any device in the examination hall, is strictly prohibited.

13.2 Disciplinary action will be initiated if any candidate indulges in any malpractice (unfair means) as enumerated in the Vidyapeeth Examination Manual.

14. Rules for Hostel Students All inmates of the Hostel shall observe the following rules for the smooth and efficient running of the hostel and for their comfortable stay: -

14.1 Only bonafide students of Vidyapeeth are eligible for admission to the hostels.

14.2 Students who fail to remit the Hostel fee even after a reminder in writing, shall vacate the hostel room allotted to them, forthwith.

14.3 No posters or pictures should be stuck inside and outside the room or anywhere around the premises of the hostel or College. Hostlers should avoid sticking bills and posters on the windows, doors and walls (except name strips on the room door). In case the room is found not in order, fine will be levied on the erring student.

14.4 Inmates should switch off fans and lights before leaving their rooms.

14.5 The inmates are advised to close the taps after use in order to avoid wastage of water.

14.6 Dining services will be provided only in the mess and there will be no room service.

14.7 Whenever any hosteller falls sick the same should be reported by him/her to the warden who will provide all necessary assistance to get appropriate treatment or medicines.

14.8 While going out of hostel the students should enter their name in the register & sign the same by mentioning proper reason.

14.9 To leave the hostel premises, permission of the Chief Warden is absolutely necessary. Students who want to stay overnight to visit their parents or guardians should approach the Chief Warden for permission. Permission will be granted only after obtaining written request from the parent/guardian duly signed by them, which will be duly entered in a register maintained in each block by the Warden.

14.10 All rooms, corridors, toilets etc. must be kept clean and any student who violates the rule shall be expelled from the hostel.

14.11 Hostel facility is provided with a view to help the student to pursue his/her studies in good environment and to facilitate/ promote his/her academic progress.

All students will be governed by the rules stated above and by those that will be framed from time to time during the academic year.

Failure on the part of the students to abide by the disciplinary rules will result in such punishment including expulsion from the College/Hostel as may be imposed by the Institution / Vidyapeeth/ Head of the Institution.

The decision of the Institution/Vidyapeeth/Head of the Institution with regard to disciplinary cases shall be final and all the students shall abide by such decisions.

15 Powers of Competent Authority (Dean/Principal/ Director at the Institute level)

The Competent authority may impose any one or more of the following punishment/s on the student found guilty of misconduct, indiscipline, in proportion thereof:

15.1 Warning/reprimand

15.2 Fine

15.3 Cancellation/withheld scholarship / award / prize / medal.

15.4 Expulsion from the Hostel.

15.5 Expulsion from the institution

15.6 Cancellation of the result of the student concerned in the examination of the Institution.

15.7 Temporary annulment from the Hostel/ Institution.

15.8 Rustication from the Institution.

16. Procedure for Inquiry

If the competent authority is satisfied that there is a prima facie case inflicting penalty, mentioned in clause No. 8, the authority shall make inquiry, in the following manner:

16.1 Due notice in writing shall be given to the student concerned about his alleged act of misconduct /indiscipline.

16.2 Student charged shall be required within 15 days of the notice to submit his/her written representation about such charge/s.

16.3 If the student fails to submit written representation within specified time limit, the inquiry may be held-ex-parte.

16.4 If the student charged desired to see the relevant documents, such of the documents, as are being taken into consideration for the purpose of proving the charge/s, may at the discretion of the inquiry authority, be shown to the student.

16.5 The student charged shall be required to produce documents, if any in support of his defense. The inquiry authority may admit relevant evidence / documents.

16.6 Inquiry Authority shall record findings on each implication ofmisconduct or indiscipline, and the reason for such finding and submit the report along with proceedings to the competent Authority

16.7 The competent Authority on the basis of findings, shall pass such orders as it deems fit.

17. Appeal

If the punishment/fine/rustication is imposed on a student by Dean/Principal/ Director, such a student shall be entitled to file an appeal before the Vice- Chancellor within thirty (30) days of the receipt of the order

COURSE STRUCTURE FOR
B. TECH. ARTIFICIAL INTELLIGENCE AND DATA SCIENCE

SEMESTER I						
Course Code	**Course Name**	**L**	**T**	**P**	**Hr**	**Cr**
BSC 101	Physics	3	0	2	5	4
BSC 102	Chemistry	3	0	2	5	4
ESC 101	Basic Electronics and Electrical Engineering	2	0	2	4	3
ESC 102	Fundamentals of programming Languages	3	0	4	7	5
HSMC 101	Communication Skills	1	2	0	3	3
BSC 103	Mathematics	3	0	0	3	3
Total		**15**	**2**	**10**	**27**	**22**

SEMESTER II						
Course Code	**Course Name**	**L**	**T**	**P**	**Hr**	**Cr**
ESC 201	Problem Solving by Programming	3	0	4	7	5
BSC 201	Computational Statistics	3	0	0	3	3
BSC 202	General Biology	2	0	0	2	2
ESC 202	Engineering Graphics and Design	1	0	4	5	3
ESC 203	Engineering Mechanics	3	0	0	3	3
ESC 204	Project Based Learning –I	0	0	4	4	2
ESC 205	Workshop and manufacturing practices-laboratory	0	0	4	4	2
Total		**12**	**0**	**16**	**28**	**20**

SEMESTER III						
Course Code	**Course Name**	**L**	**T**	**P**	**Hr**	**Cr**
BSC 301	Discrete Structure	3	0	0	3	**3**
PCC-AI 301	Data Structures and Algorithms	3	0	4	7	**5**
PCC-AI 302	Software Engineering and Project Management	3	0	4	7	5
PCC-AI 303	Database Management Systems	3	0	4	7	**5**
PCC-AI 304	Project Based Learning-II	0	1	4	5	**3**
HSMC 201	Universal Human Values-II	2	1	0	3	**3**
Total		**14**	**2**	**16**	**32**	**24**

SEMESTER IV						
Course Code	**Course Name**	**L**	**T**	**P**	**Hr**	**Cr**
PCC-AI 401	Artificial Intelligence	3	0	4	7	5
PCC-AI 402	Digital Logic Design and Processor Architecture	3	0	4	7	5
PCC-AI 403	Computer Networks	3	0	4	7	5
PCC-AI 404	R Programming	2	0	4	6	4
PCC-AI 405	Foundations of Data Science	3	0	4	7	5

Total		14	0	20	34	24
SEMESTER V						
Course Code	**Course Name**	**L**	**T**	**P**	**Hr**	**Cr**
PCC-AI 501	Big data analytics	3	0	2	5	4
PCC-AI 502	Machine Learning	3	0	2	5	4
PCC-AI 503	Web Technology	3	0	2	5	4
PCC-AI 504	Design and Analysis of Algorithm	3	0	0	3	3
PEC-AI 501	Elective-I	3	0	0	3	3
PEC-AI 502	Skill Enhancement Course-I	2	0	0	2	2
Total		**16**	**0**	**12**	**23**	**20**
Elective I (A-Human Computer Interface, B-System modeling and Design, C-Pattern Recognition, D-Structural Biology and Bioinformatics) Skill Enhancement Course I : Language-I: (Foreign Language (French/German/Japanese)/ Hindi/Marathi)						
SEMESTER VI						
Course Code	**Course Name**	**L**	**T**	**P**	**Hr**	**Cr**
PCC-AI 601	Advanced Databases	3	0	2	5	4
PCC-AI 602	Deep Learning	3	0	2	5	4
PCC-AI 603	Machine Learning & Network Security	3	0	2	5	4
PCC-AI 604	Information Retrieval	2	0	0	2	2
PEC-AI 601	Elective II	3	0	0	3	3
PEC-AI 601	Skill Enhancement Course-II/ Internship	3	0	0	3	3
Total		**17**	**0**	**6**	**23**	**20**
Elective II (A-Software architecture, B-Quantum AI, C-Robotics and Automation, D-Cognitive Computing) Skill Enhancement Course II Language-II: (Foreign Language (French/German/Japanese)/ Hindi/Marathi)/ Internship of 1 month.						
SEMESTER VII						
Course Code	**Course Name**	**L**	**T**	**P**	**Hr**	**Cr**
PEC-AI 701	Skill Enhancement Course-III	2	0	0	2	2
PCC-AI 702	Project- I/Internship	0	0	0	28	14
Total		**2**	**0**	**28**	**30**	**16**
Skill Enhancement Course-III: Front end development with HTML5, CSS3/Javascript / ReactJS/Angular						
SEMESTER VIII						
Course Code	**Course Name**	**L**	**T**	**P**	**Hr**	**Cr**
PEC-AI 801	Skill Enhancement Course-IV	2	0	0	2	2
PCC-AI 802	Project- II/Internship	0	0	0	28	14
Total		**2**	**0**	**28**	**30**	**16**
Skill Enhancement Course-IV : DevOps/Cloud (AWS/AZURE)/Salesforce						
TOTAL CREDITS-168						

Examination evaluation scheme as follows:

EVALUATION SCHEME (THEORY)

Examination **Duration** **Marks**

I Internal	45 minutes	20
II Internal	30 minutes	15
Attendance		5
End Semester	2 hours 30 minutes	60
Total		**100**

PRACTICAL EVALUATION SCHEME

Examination Marks		
Practical Internal (Continuous) assessment	**:**	**40**
End semester examination	**:**	**60**
Total	**:**	**100**

Course Code:

BSC	Basic Science Course
ESC	Engineering Science Course
PCC	Professional Core Course
PEC	Professional Elective Course
HSMC	Humanities & Social Sciences including Management

SEMESTER - I

SEMESTER I						
Course Code	**Course Name**	**L**	**T**	**P**	**Hr**	**Cr**
BSC 101	Physics	3	0	2	5	4
BSC 102	Chemistry	3	0	2	5	4
ESC 101	Basic Electronics and Electrical Engineering	3	0	2	5	4
ESC 102	Fundamentals of programming Languages	3	0	4	7	5
HSMC 101	Communication Skills	1	2	0	3	3
BSC 103	Mathematics	3	0	0	3	3
Total		**16**	**2**	**10**	**28**	**23**

Dr. D. Y. Patil School of Science& Technology,
Dr. D. Y. Patil Vidyapeeth, Pimpri, Pune

BSC 101 : Physics

Teaching Scheme	Credit Scheme	Examination Scheme and Marks
Lecture: 03 Hours/Week	04	Internal Assessment (TH): 40 Marks
Practical: 02 Hours/Week		End Semester (TH): 60 Marks

Course Objective:

The objective of this course is:

1. To create general understanding regarding basic physical principles involved in living systems.
2. To familiarize the student with basic concepts in classical physics such asclassical optics used in microscopes and telescopes, mechanics, fluid properties, oscillations and waves, electricity and magnetism
3. To introduce them to concepts in modern physics such as production ofX-rays, X-ray crystallography, quantum mechanics etc.

Course Outcomes:

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

CO1: Understand the basic concepts in physics and understand the properties of fluids, viscosity and surface tension.

CO2: Understand the basic properties of solids like elasticity and measure the Modulus by stress and strain curve.

CO3: Understand the concept of Oscillations and different types of waves

CO4: Learn about the optics, diffraction and their types, types of interference

CO5: Demonstrate the calculations of electricity and learn the different laws.

CO6:Demonstrate the concepts in modern physics such as- X-rays, crystallography and quantum Mechanics

CO7: Understand the various laser and their applications.

Prerequisites

This is an introductory course. School level knowledge of physics is sufficient.There are no prerequisites.

Unit I	Newtonian Mechanics and Fluids Properties	(10Hours)
Forces in Nature; Newton‘s laws and itscompleteness in describing particle motion; Potential energy function; F = - Grad V, Conservative and non-conservative forces, Central forces Surface Tension, Surface Energy, Angleof Contact, Capillarity action, Determination of Surface tension by capillary rise method Viscosity, Coefficient of viscosity, Streamline and turbulent flow, Reynold‘s number,Stoke‘s law, Terminal velocity, Determination of _η‘ by falling sphere method.		
Mapping of Course Outcomes	CO1	
Unit II	**Elasticity**	**(03 Hours)**

Stress and Strain, Hook‘s law, Stress-strain curve, Young‘s modulus, Determination of Young‘s modulus		
Mapping of Course Outcomes	CO2	
Unit III	**Oscillations and Waves**	**(06 Hours)**
Simple harmonic motion, Transverse wave on a string, The wave equation on a string, Reflection and transmission of waves at a boundary, Sound waves: Audible, Ultrasonic and Infrasonicwaves, Beats, Doppler effect, Applications of Ultrasonic waves.		
Mapping of Course Outcomes	CO3	
Unit IV	**Optics: Interference Diffraction & Polarization**	**(08 Hours)**
Introduction to optics, Principles of superposition, Constructive & Destructive Interference, Types of Interference, Newton‘s rings. Diffraction- Types of diffraction, Diffraction grating, Rayleigh‘s criterion, Resolving power of Microscope and Telescope. Polarization of light waves, Polaroid, Optical activity.		
Mapping of Course Outcomes	CO4	
Unit V	**Electricity, Magnetism, Electromagnetic Induction**	**(07 Hours)**
Calculation of electric field and electrostatic potential for a charge distribution; Divergence and curl of electrostatic field; Laplace‘s and Poisson‘s equations for electrostatic potential; Heating effect of electric current, Joule‘s law , Bio-Savart law,Divergence and curl of static magnetic field; vector potential and calculating it for a given magnetic field using Stokes‘ theorem Faraday‘s law in terms of EMFproduced by changing magnetic flux; Transformers, Types of Transformers.		
Mapping of Course Outcomes	CO5	
Unit VI	**Modern Physics: Xrays, Crystallography, Introduction to Quantum Mechanics**	**(08 Hours)**
Introduction to X-Rays: Introduction,Production of X-rays, X-Ray diffractionand its Applications. Plank‘s Quantum Theory, Properties of Photon, Photoelectric effect, Wave particle duality of radiation, De Broglie‘s hypothesis, Heisenberg‘s Uncertaintyprinciple. The Schrodinger equation for wave function, Statistical interpretation, Probability, Momentum		
Mapping of Course Outcomes	CO6	
Unit VII	**Lasers**	**(06 Hours)**
Properties of Lasers, Production mechanism, Ruby Laser, Helium Neon Laser, applications of Lasers		
Mapping of Course Outcomes	CO7	
Learning Resources		

Methodology

The course will be covered through lectures and supported by practical.

Reference Books:

1. Physics by D. Haliday and R. Resnik 5th edition, Wiley Eastern Pub, 2007.
2. Perspectives of Modern Physics by A. Beiser, 6th edition, Mc Graw Hill,2003.
3. Fundamensls of optics by F. A. Jenkins and H. E. White, 4th edition, McGraw Hill, 1976.
4. Optics by A. Ghatak, 3rd edition, Tata Mc Graw Hill, 2006.
5. David Griffiths, Introduction to Electrodynamics, 3rd edition, 1999,Prentice Hall
6. David Griffiths, Introduction to Quantum Mechanics, 2nd edition, 2005,Prentice Hall

Practical :

1. Diffraction Grating: Use of diffraction grafting for determination ofwavelength of
2. Spectral lining.
3. Resolving Power: To determine the resolving power of Microscope ortelescope
4. Ultrasonic Interferometer: Determination of velocity of ultrasonic wavesby ultrasonic
5. Surface Tension: Determination of the surface tension of a given solution.
6. Viscosity: Determination the coefficient of viscosity by Stoke‘s methodand its
7. Practical application.
8. Joule‘s Law: Determine of Joule‘s constant.
9. Determination of wavelength of monochromatic light by Newton‘s ringsexperiments.

@The CO-PO Mapping Matrix

CO\PO	PO1	PO2	PO 3	PO 4	PO 5	PO 6	PO7	PO 8	PO9	PO1 0	PO1 1	PO12
CO1	1	1	2	1	-	-	-	-	-	-	-	-
CO2	1	2	-	2	-	-	-	-	-	-	-	-
CO3	2	1	2	1	-	-	-	-	-	-	-	-
CO4	1	2	-	2	-	-	-	-	-	-	-	-
CO5	-	-	2	-	-	-	-	-	-	-	-	-
CO6	-	2	1	2	-	-	-	-	-	-	-	-

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BSC 102: Chemistry

Teaching Scheme	Credit Scheme	Examination Scheme and Marks
Lecture: 03 Hours/Week	04	Internal Assessment (TH): 40 Marks
Practical: 02 Hours/Week		End Semester (TH): 60 Marks

Course Objective:

1. The objective of this course is to familiarize the student with the different concepts of physical and organic chemistry.
2. The students will learn the structures of organic molecules as: alkanes, alkenes, alkynes, aliphatic and aromatic molecules and the stereochemistry behind the molecules with its importance in day today life
3. They would learn the Basic concepts and principles with respect to physical chemistry, the bioenergetics of different reactions and the principles and applications of radioactivity.

Course Outcomes:

The course will enable the student to:

CO1: Analyze microscopic chemistry in terms of atomic and molecular orbitals and intermolecular forces.
CO2: Rationalize bulk properties and processes using thermodynamic considerations. Distinguish the ranges of the electromagnetic spectrum used for exciting different molecular energy levels in various spectroscopic techniques
CO3: Rationalize periodic properties such as ionization potential, electronegativity, oxidation states and electronegativity.
CO4: List major chemical reactions that are used in the synthesis of molecules.
CO5: understand ionization energies and variations in Periodic atoms
CO6: configuration and representation of isomers
CO7: addition, oxidation, elimination and substitution of reaction

Prerequisites:

This is the introductory course and there are no prerequisites.

Unit I	Atomic and molecular structure	(10 Hours)

Schrodinger equation. Particle in a box solutions and their applications for conjugated molecules and nanoparticles. Forms of the hydrogen atom wave functions and the plots of these functions to explore their spatial variations. Molecular orbitals of diatomic molecules and plots of the multicenter orbitals. Equations for atomic and molecular orbitals. Energy level diagrams of diatomic. Pi-molecular orbitals of butadiene and benzene and aromaticity.		
Mapping of Course Outcomes	CO1	
Unit II	**Spectroscopic techniques and applications**	**(07 Hours)**
Principles of spectroscopy Electronic spectroscopy. Fluorescence and its applications in medicine. Vibrational and rotational spectroscopy of diatomic, molecules. Applications. Nuclear magnetic resonance and magnetic resonance imaging		
Mapping of Course Outcomes	CO2	
Unit III	**Intermolecular forces and potential energy surfaces**	**(04 Hours)**
Ionic, dipolar and van Der Waals interactions. Equations of state of real gases and critical phenomena. Potential energy surfaces of H3, H2F and HCN and trajectories on these surfaces.		
Mapping of Course Outcomes	CO3	
Unit IV	**Thermo- dynamics**	**(08 Hours)**
Thermodynamic functions: energy, entropy and free energy. Estimations of entropy and free energies. Free energy and emf. Cell potentials, the Nernst equation and applications. Use of free energy considerations in metallurgy through Ellingham diagrams.		
Mapping of Course Outcomes	CO4	
Unit V	**Periodic properties**	**(06 Hours)**
Effective nuclear charge, penetration of orbitals, variations of s, p, d and f orbital energies of atoms in the periodic table, electronic configurations, atomic and ionic sizes, ionization energies, electron affinity and electronegativity, polarizability, oxidation states, coordination numbers and geometries		
Mapping of Course Outcomes	CO5	
Unit VI	**Stereo- chemistry**	**(06 Hours)**
Representations of 3 dimensional structures, structural isomers and stereoisomers, configurations and symmetry and chirality, enantiomers, diastereomers, optical activity, absolute configurations and conformational analysis. Isomerism in transitional metal compounds		
Mapping of Course Outcomes	CO6	
Unit VII	**Organic reactions**	**(05 Hours)**
Introduction to reactions involving substitution, addition, elimination, oxidation, reduction, cyclization and ring openings.		
Mapping of Course Outcomes	CO7	

Methodology

The course will be covered through lectures, demonstration and practical.

Reference Books:

1. University chemistry, by B. H. Mahan
2. Chemistry: Principles and Applications, by M. J. Sienko and R. A. Plane
3. Fundamentals of Molecular Spectroscopy, by C. N. Banwell
4. Engineering Chemistry (NPTEL Web-book), by B. L. Tembe, Kamaluddin and M. S. Krishnan
5. Physical Chemistry, by P. W. Atkins
6. Organic Chemistry: Structure and Function by K. P. C. Volhardt and N. E. Schore, 5th Ed. http://bcs.whfreeman.com/vollhardtschore5e/ default.asp

Practical:

1	Determination of surface tension and viscosity
2	Spectroscopy
3	Measurement of Optical activity.
4	Determination of chloride content of water OR Chemical analysis of a salt
5	Colligative properties using freezing point depression
6	Determination of the rate constant of a reaction
7	Determination of cell constant and conductance of solutions
8	Potentiometry - determination of redox potentials and emfs
9	Determination of the partition coefficient of a substance between two immiscible liquids
10	Adsorption of acetic acid by charcoal

@The CO-PO Mapping Matrix

CO \PO	PO 1	PO 2	PO 3	PO 4	PO 5	PO 6	PO 7	PO 8	PO 9	PO 10	PO 11	PO 12
CO 1	1	1	2	1	-	-	-	-	-	-	-	-
CO 2	1	2	-	2	-	-	-	-	-	-	-	-
CO 3	2	1	2	1	-	-	-	-	-	-	-	-
CO 4	1	2	-	2	-	-	-	-	-	-	-	-
CO 5	-	-	2	-	-	-	-	-	-	-	-	-
CO 6	-	2	1	2	-	-	-	-	-	-	-	-

Co 7	1	2	2	-	-	-	-	-	-	-	-	-

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ESC 101: Basic Electronics and Electrical Engineering

Teaching Scheme	Credit Scheme	Examination Scheme and Marks
Lecture: 02 Hours/Week	03	Internal Assessment (TH): 40 Marks
Practical: 02 Hours/Week		End Semester (TH): 60 Marks

Course Objective:

1. To understand the fundamentals of electronic circuit constructions.
2. To learn the fundamental laws, theorems of electrical circuits and also toanalyze them
3. To study the basic principles of electrical machines and their performance
4. To study the different energy sources, protective devices and their fieldapplications
5. To understand the principles and operation of measuring instruments andtransducers

Course Outcomes:

Upon completion of the course, the students will be able to:

CO1: Discuss the essentials of electric circuits and analysis.

CO2: Discuss the basic operation of electric machines and transformers

CO3: Introduction of renewable sources and common domestic loads.

CO4: Introduction to measurement and metering for electric circuits

CO5: To understand the principles and operation of measuring instruments andtransducers

Prerequisites:

Basic knowledge of Electronics Circuits.

Unit I	**Introduction to Electronics**	**(06 Hours)**
Evolution of Electronics, Impact ofElectronics in industry and in society. Introduction to active and passive components, P-type Semiconductor, N-typeSemiconductor. Current in semiconductors (Diffusion and Drift Current) P-N Junction Diode: P-N Junction diode construction and its working in forward and reverse bias condition, V-I characteristics of P-N junction Diode, Diode as a switch, Half Wave Rectifier, Full wave and Bridge Rectifier.		
Mapping of Course Outcomes	CO1	
Unit II	**Transistor and OPAMP**	**(08 Hours)**
Bipolar Junction Transistor: Construction,type, Operation, V-I Characteristics, region ofoperation, BJT as switch and CE amplifier, Op-amp as Inverting and Non inverting amplifier, applications of operational amplifier		
Mapping of Course Outcomes	CO2	

Home

Unit III	Number System and Logic Gates	(08 Hours)
Number System: - Binary, BCD, Octal,Decimal, Hexadecimal De-Morgan's theorem. Basic Gates:- AND, OR, NOT, Universal Gate- XOR, XN Flip Flop's SR, JK,T and D Introduction to Microprocessor and Microcontroller		
Mapping of Course Outcomes	CO3	
Unit IV	**Electrical Circuits Analysis**	**(06 Hours)**
Ohms Law, Kirchhoff's Law-Instantaneouspower- series and parallel circuit analysis with resistive, capacitive and inductive network - nodal analysis, mesh analysis		
Mapping of Course Outcomes	CO4	
Unit V	**Network theorems**	**(08 Hours)**
Network theorems - Theremins theorem, Norton theorem, maximum power transfertheorem and superposition theorem, three phase supply-Instantaneous, Reactive and apparent power-star delta conversion.		
Mapping of Course Outcomes	CO5	

Methodology:

The course will be covered through lectures, demonstration and practical.

Practicals:

1. Study of different electronic components.
   a) Resistors (Carbon Film, Metal Film, Wire wound,Variable)
   b) Capacitors (Electrolytic, Mica, Ceramic, variable)
   c) Inductors, transformers d. Relay, switches, and connectors

2 Study of basic electronics measuring instruments.
   a) To study different controls of DMM and measurements ofparameters like AC & DC voltage, current
   b) To study controls of CRO, measurements of frequency,phase, AC and DC voltages
   c) To study various controls of function generator

3 Study of DC regulated power supply

4 Study of semiconductor devices, P-N junction Diode. Plot VIcharacteristics of P-N junction diode.

5 Study of single stage BJT common emitter amplifier circuit

6 Study of operational amplifier
   a. Op-amp IC741
   b. Op-amp as inverting and non-inverting amplifier.

7 Study of digital logic circuits.

a. Truth table verification of AND, OR, NOT, NAND, NOR
b. Implement half adder circuit with logic gate ICs.

8 Verification of super position, Thevenin and Norton‘s theorem

9 Study of Series RLC circuit (Power measurement, Phasordiagram)

10 Study of single phase and three phase transformers

@The CO-PO Mapping Matrix

CO\ PO	PO1	PO2	PO3	PO4	PO 5	PO6	PO7	PO 8	PO9	PO1 0	PO1 1	PO 12
CO	1	1	2	1	-	-	-	-	-	-	-	-
CO 2	1	2	-	2	-	-	-	-	-	-	-	-
CO 3	2	1	2	1	-	-	-	-	-	-	-	-
CO 4	1	2	-	2	-	-	-	-	-	-	-	-
CO 5	-	-	2	-	-	-	-	-	-	-	-	-
CO 6	-	2	1	2	-	-	-	-	-	-	-	-
Co7	1	2	2	-	-	-	-	-	-	-	-	-

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ESC 102: Fundamentals of Programming Languages

Teaching Scheme	Credit Scheme	Examination Scheme and Marks
Lecture: 03 Hours/Week	05	Internal Assessment (TH): 40 Marks
Practical: 04 Hours/Week		End Semester (TH): 60 Marks

Course Objective:

The objective of the course is

1. To familiarize the students with computers and programming concepts.
2. Programming module is intended to familiarize them with computer logicand solution of real-world problems using C and C++ programming languages.

Course Outcomes:

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

CO1: Understand the organization of computers and the basic principles ofComputing

CO2: Deal with the basics problems that arise while using computers

CO3: Demonstrate the basics of C Programing and their applications

CO3: Demonstrate the basics of object-oriented programming (C++)

CO4: Apply programming for solving biological problems by logic-basedapproach

CO5: Understand the different types of array and string

CO6: Demonstrate the pointer with array and function

CO7: Understand the structure, union, enumeration

CO8: Different file handling function

Prerequisites:

The course requires the basic knowledge about the Computer system.

Unit I	**Basics of programming & Introduction to C**	**(08 Hours)**
History of computer and various parts and functions performed by them , Various hardware of computer, Application software and system software , Various functions of operating system, MS-DOS, LINUX commands, Machine language, High level language, Compilation process ,An overviewof C, C expressions, Operators, Data types		
Mapping of Course Outcomes	CO1	

Unit II	The Decision controls and Control structures	(08 Hours)
If statements within if, Multiple statements within if, if-else statement, The! operator Hierarchy of Logical Operators, The Conditional Operators. What are Control structures, need of controlstructures , While‘ Loop, for‘ loop , Nesting of Loops , Multiple Initializations in the for loop The Odd‘ Loop, The break‘ statement, The continue‘ statement, The do-while‘ statement, Decisions using switch , Go To Statements		
Mapping of Course Outcomes	CO2	
Unit III	**Functions, Pointers and Structures**	**(08 Hours)**
What is a function? Why Use Functions Passing values between functions, Scope offunction. Pointer variables , The pointer Operators , Pointer Expressions , Pointers and Arrays , Initializing Pointers, Pointers to Functions, C‘s Dynamic Allocation Arrays Structures, Arrays of structures, Passingstructures to functions, Structure Pointers, Unions, Bit-Fields , Enumerations ,Typedef		
Mapping of Course Outcomes	CO4, CO6,CO7	
Unit IV	**Array & strings**	**(08 Hours)**
Single-dimension Arrays, Generating aPointer to an array, Passing single dimension, arrays to functions, Strings, Two- dimensional Arrays, Arrays of Strings, Multidimensional Arrays, Array ,Initialization, Variable-Length arrays Whatare Strings? More about Strings , Pointers andStrings , Standard Library String functions,Two-Dimensional Array of Characters, Array of pointers to Strings		
Mapping of Course Outcomes	CO5	
Unit V	**File Handling in C**	**(08 Hours)**
Opening and closing a stream, open modes, Reading and writing to/from a stream, Predefined streams: stdin, stdout and stderr, Stream manipulation: fgetc(), fputc(), fgets() and fputs() functions		
Mapping of Course Outcomes	CO7	
Unit VI	**Introduction To Object- Oriented Programming (C++)**	**(08 Hours)**
Introduction – Procedure vs. object oriented programming – Data types – control structures – Arrays and Strings – User definedtypes – Functions and Pointers – Case study ,Classes and Objects – Operator Overloading – Inheritance – Polymorphism and VirtualFunctions – Case study		
Mapping of Course Outcomes	CO3	

Reference Books:

1. The complete reference of C by H. Schildt, 4th edition, Mc Graw Hill,2003.
2. Let us C By Y. Kanitkar, 15th edition, BPB Publication, 2017.
3. Data Structure Through C by Y. Kanitakar, 2nd edition, BPB Publication,2003.
4. Understanding Pointers in C by Y. Kanitakar, 4th edition, BPB Publication,2007.
5. Data Structure using C and C++ by A. M. Taneumbam, 2nd edition, PHI,2017.
6. Computers Fundamentals by P K Sinha and P. Sinha, 6th edition, BPBpublications, 2004.

7. HM Deitel and PJ Deitel —C++ How to Program‖, Seventh Edition, 2010,Prentice Hall.
8. E Balagurusamy, —Object oriented Programming with C++‖, Thirdedition, 2006, Tata McGraw Hill.

Methodology:

The course will be covered through lectures, demonstration and practical**.**

Practical's:

1 Introduction to Microsoft Word and Microsoft Power point
2 Introduction to Microsoft Excel and MS-DOS commands
3 Programs on basic programming in C
4 Programs using Decision Controls in C
5 Programs using while, do-while and for Loop
6 Programs using Case Control Structure, odd loop
7 Programs illustrating use of function
8 Programs illustrating use of arrays
9 Programs using Pointers and Structure
10 Programs illustrating use of String
11 Programs for file handling in C
12 Programs in basic programming in C++
13 Basic programs for object-oriented concepts using C++
14 Programs for Biological application
- Finding complement of DNA
- ORF finding
- Inverted Repeats
- Motif finding
- Translation
- Transcription

@The CO-PO Mapping Matrix

CO\ PO	PO1	PO2	PO3	PO4	PO 5	PO6	PO7	PO 8	PO9	PO1 0	PO1 1	PO 12
CO	1	1	2	1	-	-	-	-	-	-	-	-
CO 2	1	2	-	2	-	-	-	-	-	-	-	-
CO 3	2	1	2	1	-	-	-	-	-	-	-	-
CO 4	1	2	-	2	-	-	-	-	-	-	-	-
CO	-	-	2	-	-	-	-	-	-	-	-	-

5												
CO 6	-	2	1	2	-	-	-	-	-	-	-	-
Co7	1	2	2				-	-	-	-	-	-

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HSMC 101: Communication Skills

Teaching Scheme	Credit Scheme	Examination Scheme and Marks
Lecture: 01 Hours/Week	03	Internal Assessment (TH): 40 Marks End Semester (TH): 60 Marks

Course Objective:

1. Understand the role of communication in personal & professional success.
2. Develop awareness of appropriate communication strategies.
3. Prepare and present messages with a specific intent.
4. Analyze a variety of communication acts.
5. Ethically use, document and integrate source

Course Outcomes:

CO1: The student will acquire basic proficiency in English including reading andlistening comprehension, writing and speaking skills.
CO2: Develop knowledge, skills, and judgment around human communication that facilitate their ability to work collaboratively with others.
CO3:Understand and practice different techniques of communication
CO4: Practice and adhere to the 7Cs of Communication.
CO5: Familiarize with different types of Communication.
CO6: Understand and practice Interview Etiquettes.

Unit I	**Vocabulary Building**	**(03 Hours)**
The concept of Word Formation, Root words from foreign languages and their usein English, Acquaintance with prefixes andsuffixes from foreign languages in English to form derivatives., Synonyms, antonyms,and standard abbreviations.		
Mapping of Course Outcomes	CO1	
Unit II	**Basic Writing Skills**	**(03 Hours)**
Sentence Structures, Use of phrases and clauses in sentences Importance of proper punctuation, Creating coherence Organizing principles of paragraphs in documents, Techniques for writing precisely		
Mapping of Course Outcomes	CO2	
Unit III	**Identifying Common Errors in Writing**	**(03 Hours)**

Subject-verb agreement, Noun-pronounagreement Misplaced modifiers, Articles, PrepositionsRedundancies, Clichés		
Mapping of Course Outcomes	CO3	
Unit IV	**Nature and Style of sensible Writing**	**(08 Hours)**
Describing, Defining, Classifying,Providing examples or evidence, Writing introduction and conclusion		
Mapping of Course Outcomes	CO4	
Unit V	**Writing Practices**	**(08 Hours)**
Comprehension, Précis Writing, EssayWriting		
Mapping of Course Outcomes	CO5	
Unit VI	**Oral Communication**	**(08 Hours)**
(This unit involves interactive practice sessions in Language Lab) Listening Comprehension, Pronunciation, Intonation, Stress and Rhythm, Common Everyday Situations: Conversations and Dialogues, Communication at Workplace, Interviews, Formal Presentations		
Mapping of Course Outcomes	CO6	

Reference Book:

a. Practical English Usage. Michael Swan. OUP. 1995.
b. Remedial English Grammar. F.T. Wood. Macmillan.2007
c. On Writing Well. William Zinsser. Harper Resource Book. 2001
d. Study Writing. Liz Hamp-Lyons and Ben Heasly. Cambridge University Press. 2006.
e. Communication Skills Sanjay Kumar and Pushp Lata. Oxford University Press. 2011.
f. Exercises in Spoken English. Parts. I-III. CIEFL, Hyderabad. Oxford University Press

@The CO-PO Mapping Matrix

CO\ PO	PO1	PO2	PO3	PO4	PO 5	PO6	PO7	PO 8	PO9	PO1 0	PO1 1	PO 12
CO	1	1	2	1	-	-	-	-	-	-	-	-
CO 2	1	2	-	2	-	-	-	-	-	-	-	-
CO 3	2	1	2	1	-	-	-	-	-	-	-	-
CO 4	1	2	-	2	-	-	-	-	-	-	-	-
CO 5	-	-	2	-	-	-	-	-	-	-	-	-
CO 6	-	2	1	2	-	-	-	-	-	-	-	-
Co7	1	2	2	-	-	-	-	-	-	-	-	-

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BSC 103: Mathematics

Teaching Scheme	Credit Scheme	Examination Scheme and Marks
Lecture: 03 Hours/Week	03	Internal Assessment: 40 Marks
		End Semester: 60 Marks

Course Objective

The objective of the course is to familiarize the student with basic concepts inmathematics.

Course Outcomes:

The objective of this course is to familiarize the prospective engineers withtechniques in calculus, multivariate analysis and linear algebra. It aims to equipthe students with standard concepts and tools at an intermediate to advancedlevel that will serve them well towards tackling more advanced level ofmathematics and applications that they would find useful in their disciplines. The students will learn:

CO1: To apply differential and integral calculus to notions of curvature and to improper integrals. Apart from some other applications they will have a basic understanding of Beta and Gamma functions.

CO2: The tool of power series and Fourier series for learning advanced Engineering Mathematics.

CO3: To deal with functions of several variables that are essential in most branches of engineering.

CO4: The essential tool of matrices and linear algebra in a comprehensive manner.

CO5: To deal with thermos, transformations, and equations.

Prerequisites:

Students should be familiar with school level mathematics to take up this course. In case they do not have mathematics at the 10+2 level they should have cleared the core mathematics in the first semester.

Unit I	**Calculus**	**(06 Hours)**
Evaluate and involutes; Evaluation of definite and improper integrals; Beta and Gamma functions and their properties; Applications of definite integrals to evaluate surface areas.		
Mapping of Course Outcomes	CO1	
Unit II	**Calculus**	**(06 Hours)**
Expansion of Functions: Taylor's seriesand Maclaurin's Series; Differential Calculus: Indeterminate Forms, L -Hospital's Rule, Evaluation of Limits		
Mapping of Course Outcomes	CO2	
Unit III	**Sequences and series**	**(10 Hours)**

Infinite Sequences, Infinite Series,Alternating Series, Tests for Convergence, Absolute and Conditional Convergence, Range of convergence.		
Mapping of Course Outcomes	CO3	
Unit IV	**Multivariable Calculus**	**(08 Hours)**
Partial Derivatives, Euler's Theorem onHomogeneous Functions, ImplicitFunctions, Total Derivatives, Change of Independent Variables; Maxima and Minima of functions of two variables, Lagrange's method of undetermined multiplier		
Mapping of Course Outcomes	CO4	
Unit V	**Matrices**	**(10 Hours)**
Rank, Normal Form, System of Linear equations, Linear Dependence and Independence, Linear and Orthogonal Transformations. Eigen values, Eigen Vectors, Cayley Hamilton Theorem.		
Mapping of Course Outcomes	CO5	

Reference Book:

1. G.B. Thomas and R.L. Finney, Calculus and Analytic geometry, 9thEdition, Pearson, Reprint, 2002.
2. Erwin kreyszig, Advanced Engineering Mathematics, 9th Edition, JohnWiley & Sons, 2006.
3. Veerarajan T., Engineering Mathematics for first year, Tata McGraw-Hill,New Delhi, 2008.
4. Ramana B.V., Higher Engineering Mathematics, Tata McGraw Hill NewDelhi, 11th Reprint, 2010.
5. D. Poole, Linear Algebra: A Modern Introduction, 2nd Edition,Brooks/Cole, 2005.
6. N.P. Bali and Manish Goyal, A text book of Engineering Mathematics,Laxmi Publications, Reprint.
7. B.S. Grewal, Higher Engineering Mathematics, Khanna Publishers, 36thEdition, 2010.
8. Dr. M.Y Gokhale, Dr. N.S. Mujumdar Engineering Mathematics-I, NiraliPrakashan, 8th Edition.

@The CO-PO Mapping Matrix

CO\ PO	PO1	PO2	PO3	PO4	PO 5	PO6	PO7	PO 8	PO9	PO1 0	PO1 1	PO 12
CO	1	1	2	1	-	-	-	-	-	-	-	-
CO 2	1	2	-	2	-	-	-	-	-	-	-	-
CO 3	2	1	2	1	-	-	-	-	-	-	-	-
CO 4	1	2	-	2	-	-	-	-	-	-	-	-
CO 5	-	-	2	-	-	-	-	-	-	-	-	-
CO 6	-	2	1	2	-	-	-	-	-	-	-	-
Co7	1	2	2	-	-	-	-	-	-	-	-	-

PRACTICALS

1. Diffraction Grating: Use of diffraction grafting for determination of
1. principles and applications of radioactivit

SEMESTER - II

SEMESTER II						
Course Code	**Course Name**	**L**	**T**	**P**	**Hr**	**Cr**
ESC 201	Problem Solving by Programming	3	0	4	7	5
BSC 201	Computational Statistics	3	0	0	3	3
BSC 202	General Biology	2	1	0	3	3
ESC 202	Engineering Graphics and Design	1	0	4	5	3
ESC 203	Engineering Mechanics	3	0	0	3	3
ESC 204	Project Based Learning –I	0	0	4	4	2
ESC 205	Workshop and manufacturing practices-laboratory	0	0	4	4	2
	Total	**12**	**1**	**16**	**29**	**21**

Dr. D. Y. Patil School of Science &Technology,
Dr D. Y. Patil Vidyapeeth, Pimpri, Pune

ESC 201 : Problem Solving by Programming

Teaching Scheme	Credit Scheme	Examination Scheme and Marks
Lecture: 03 Hours/Week	05	Internal Assessment (TH): 40 Marks
Practical: 04 Hours/Week		End Semester (TH): 60 Marks

Course Objective:

Prime objective is to give students a basic introduction to programming and problem solving with computer language Python. And to introduce students not merely to the coding of computer programs, but to computational thinking, the methodology of computer programming, and the principles of good program design including modularity and encapsulation.

1. To understand problem solving, problem solving aspects, programming and to know about various program design tools.
2. To learn problem solving with computers
3. To learn basics, features and future of Python programming.
4. To acquaint with data types, input output statements, decision making, looping and functions in Python
5. To learn features of Object-Oriented Programming using Python.

Course Outcomes:

On completion of the course, learner will be able to–

CO1: Inculcate and apply various skills in problem solving.

CO2: Choose most appropriate programming constructs and features to solvethe problems in diversified domains.

CO3: Exhibit the programming skills for the problems those require the writingof well- documented programs including use of the logical constructs of language, Python.

CO4: Demonstrate significant experience with the Python programdevelopment environment.

CO5: demonstrate with the polymorphism, inheritance, class, object like object oriented programming.

CO6: learn about the file handling and Dictionaries with case studies.

Prerequisites:

Students are expected to have a good understanding of basic computer principles.

Unit I	Problem Solving, Programming and Python Programming General Problem Solving Concepts	(07 Hours)
Problem solving in everyday life, types of problems, problem solving with computers, difficulties with problemsolving, Problem solving aspects, top down design. Problem Solving Strategies. **Program Design Tools:** Algorithms, Flowcharts and Pseudocodes, implementation of algorithms. **Basics ofPython Programming:** Features of Python, History and Future of Python, Writing and executing Python program, Literal constants, variables andidentifiers, Data Types, Input operation, Comments, Reserved words, Indentation, Operators and expressions, Expressions in Python.		
Mapping of Course Outcomes	CO1	
Unit II	**Decision Control Statements Decision Control Statements**	**(08 Hours)**
Decisioncontrol statements, **Selection/conditional** branching Statements: if, if-else, nested if, if elif-else statements. **Basic loop**Structures/Iterative statements: whileloop, for loop, selecting appropriate loop.Nested loops, The break, continue, pass,else statement used with loops. Other data types- Tuples, Lists and Dictionary.		
Mapping of Course Outcomes	CO2	
Unit III	**Functions and Modules**	**(08 Hours)**
Need for functions, **Function**: definition,call, variable scope and lifetime, the return statement. Defining functions,Lambda or anonymous function, documentation string, good programming practices. Introduction to modules, Introduction to packages in Python, Introduction to standard library modules.		
Mapping of Course Outcomes	CO3	
Unit IV	**Strings**	**(07 Hours)**
Strings and Operations- concatenation,appending, multiplication and slicing. Strings are immutable, strings formatting operator, built in string methods and functions. Slice operation, ord() and chr() functions, in and not in operators, comparing strings, Iterating strings, the string module		
Mapping of Course Outcomes	CO4	
Unit V	**Object Oriented Programming**	**(08 Hours)**
Programming Paradigms-monolithic,procedural, structured and objectoriented, Features of Object-oriented Programming classes, objects, methods and message passing, inheritance, polymorphism,containership, reusability, delegation, data abstraction and encapsulation. **Classes and Objects**: classes and objects, class method and self-object,class variables and object variables, public and private members, class methods.		
Mapping of Course Outcomes	CO5	
Unit VI	**File Handling and Dictionaries**	**(08 Hours)**
Files: Introduction, File path, Types of files, Opening and Closing files, Readingand Writing files. Dictionary method. **Dictionaries-** creating, assessing, addingand updating values. **Case Study:** Studydesign, features, and use of any recent, popular and efficient system developed using Python. (This topic is to beexcluded for theory examination).		

Mapping of Course Outcomes	CO6

Text Books:

1. Reema Thareja, ―Python Programming Using Problem Solving Approach‖, Oxford University Press, ISBN 13: 978-0-19-948017-6
2. R. Nageswara Rao, ―Core Python Programming‖, Dreamtech Press;Second edition ISBN-10: 938605230X, ISBN-13: 978-9386052308 ASIN: B07BFSR3LL

Reference Books:

1. R. G. Dromey, ―How to Solve it by Computer‖, Pearson Education India; 1st edition, ISBN-8131705625, ISBN-13: 978-8131705629 Maureen Spankle, ―Problem Solving and Programming Concepts‖,
2. Romano Fabrizio, ―Learning Python‖, Packt Publishing Limited, ISBN:9781783551712, 1783551712
3. Paul Barry, ―Head First Python- A Brain Friendly Guide‖, SPD O'Reilly,2nd Edition, ISBN:978-93-5213-482-34
4. Martin C. Brown, ―Python: The Complete Reference‖, McGraw HillEducation, ISBN-10:

   9789387572942, ISBN-13: 978-9387572942, ASIN: 9387572943
6. Jeeva Jose, P. Sojan Lal, ―Introduction to Computing & Problem Solvingwith Python‖,
7. Khanna Computer Book Store; First edition, ISBN-10: 9789382609810,ISBN-13: 978-938260981
8. Brian W. Kernighan and Dennis M. Ritchie, The C Programming Language, Prentice Hall of India

Practical :

1. Write a program to calculate salary of employee. Let HRA be 10 % of basic pay and TA be 5% of basic pay. Let employee pay professional tax as 2% of total salary. Calculate net salary payable after deductions.
2. To accept an object mass in kilograms and velocity in meters per second and display its momentum. Momentum is calculated ase=mc2 where m is the mass of the object and c is its velocity.
3. To accept student's five courses marks and compute his/her result. Student is passing if he/she scores marks equal to and above 40 in each course. If student scores aggregate greater than 75%, then the grade is distinction. If aggregate is 60>= and <75 then the grade if first division. If aggregate is 50>= and <60, then the grade is second division. If aggregate is 40>= and <50, then the grade is third division.
4. To accept N numbers from user. Compute and display maximum inlist, minimum in list, sum and average of numbers.
5. To check whether input number is Armstrong number or not. An Armstrong number is an integer with three digits such that the sumof the cubes of its digits is equal to the number itself. Ex. 371.
6. To accept the number and Compute a) square root of number, b) Square of number, c) Cube of number d) check for prime, d) factorialof number e) prime factors
7. To accept two numbers from user and compute smallest divisor andGreatest Common Divisor of these two numbers.
8. To accept a number from user and print digits of number in a reverseorder.
9. To input binary number from user and convert it into decimal number.
10. To generate pseudo random numbers.
11. To accept list of N integers and partition list into two sub lists evenand odd numbers.

12. To accept the number of terms a finds the sum of sine series.
13. To accept from user the number of Fibonacci numbers to be generated and print the Fibonacci series. Write a python program thataccepts a string from user and perform following string operations-i. Calculate length of string ii. String reversal iii. Equality check of two strings iii. Check palindrome ii. Check substring
14. To copy contents of one file to other. While copying a) all full stopsare to be replaced with commas b) lower case are to be replaced with upper case c) upper case are to be replaced with lower case.
15. To count total characters in file, total words in file, total lines in fileand frequency of given word in file. Create class EMPLOYEE for storing details(Name, Designation, gender, Date of Joining and Salary).
16. Define function members to compute a) total number of employeesin an 18. organization b) count of male and female employee c)Employee with salary more than 10,000 d) Employee withdesignation ―Asst Manager
17. Create class STORE to keep track of Products (Product Code, Nameand price). Display menu of all products to user. Generate bill as perorder.
18. Program that simulates rolling dice. When the program runs, it willrandomly choose a number between 1 and 6 (Or other integer you prefer). Print that number. Request user to roll again. Set the 20. min and max number that dice can show. For the average die, that means a minimum of 1 and a maximum of 6.

Use raspberry pi/or similar kit and python for-

a) Room Temperature Monitoring System
b) Motion Detection System
c) Soil Moisture Sensor
d) Home Automation System
e) A robot
f) Smart mirror or a smart clock.
g) Smile Detection using Raspberry Pi Camera

19. Guess Number: Randomly generate a number unknown to the user. The user needs to guess what that number is. If the user‘s guess is wrong, the program should return some sort of indication as to how wrong (e.g. the number is too high or too low). If the user guesses correctly, a positive indication should appear.
20. Write functions to check if the user input is an actual number, to see the difference between the inputted number and the randomlygenerated numbers, and to then compare the numbers.

CO\ PO	**PO1**	**PO2**	**PO3**	**PO4**	**PO 5**	**PO6**	**PO7**	**PO 8**	**PO9**	**PO1 0**	**PO1 1**	**PO 12**
CO	1	1	2	1	-	-	-	-	-	-	-	-
CO 2	1	2	-	2	-	-	-	-	-	-	-	-
CO 3	2	1	2	1	-	-	-	-	-	-	-	-
CO 4	1	2	-	2	-	-	-	-	-	-	-	-

CO 5	-	-	2	-	-	-	-	-	-	-	-	-
CO 6	-	2	1	2	-	-	-	-	-	-	-	-

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BSC 201: Computational Statistics

Teaching Scheme	Credit Scheme	Examination Scheme and Marks
Lecture: 03 Hours/Week	03	Internal Assessment: 40 Marks End Semester (TH): 60 Marks

Course Objective:

The objective of this course is to familiarize the students with statistical techniques. It aims to equip the students with standard concepts and tools at anintermediate to advanced level that will serve them well towards tackling various problems in the discipline.

Course Outcomes:

The course will enable the student to:

The students will learn:

CO1: The ideas of probability and random variables and various discrete andcontinuous probability distributions and their properties.

CO2: The basic ideas of statistics including measures of central tendency,correlation and regression.

CO3: The statistical methods of studying data samples.

CO4: Communicate the results of statistical analyses effectively.

CO5: understand method of least squares and Test of significance

CO6: Demonstrate the correlation coefficients

Unit I	Basic Probability	(12 Hours)
Probability spaces, conditional probability, independence; Discrete random variables, Independent random variables, the multinomial distribution, Poisson approximation to the binomialdistribution, infinite sequences of Bernoulli trials, sums of independent random variables; Expectation of Discrete Random Variables, Moments, Variance of a sum, Correlation coefficient, Chebyshev's Inequality.		
Mapping of Course Outcomes	CO1	
Unit II	**Continuous Probability Distributions**	**(04 Hours)**
Continuous random variables and theirproperties, distribution functions and densities, normal, exponential and gamma densities.		
Mapping of Course Outcomes	CO2	

Unit III	Bivariate Distributions	(04 Hours)
Bivariate distributions and theirproperties, distribution of sums and quotients, conditional densities, Bayes'rule.		
Mapping of Course Outcomes	CO3	
Unit IV	**Basic Statistics**	**(08 Hours)**
Measures of Central tendency: Moments,skewness and Kurtosis - Probabilitydistributions: Binomial, Poisson and Normal - evaluation of statistical parameters for these three distributions, Correlation and regression – Rank correlation.		
Mapping of Course Outcomes	CO4	
Unit V	**Applied Statistics**	**(08 Hours)**
Curve fitting by the method of least squares- fitting of straight lines, second degree parabolas and more general curves. Test of significance: Large sample test for single proportion, difference of proportions, single mean, difference of means, and difference of standard deviations.		
Mapping of Course Outcomes	CO5	
Unit VI	**Small samples**	**(04 Hours)**
Test for single mean, difference of meansand correlation coefficients, test for ratio of variances - Chi-square test for goodness of fit and independence of attributes.		
Mapping of Course Outcomes	CO6	

Reference Books:

1. Erwin Kreyszig, Advanced Engineering Mathematics, 9th Edition, JohnWiley & Sons, 2006.
2. P. G. Hoel, S. C. Port and C. J. Stone, Introduction to Probability Theory,Universal Book Stall.
3. S. Ross, A First Course in Probability, 6th Ed., Pearson Education India,2002.
4. W. Feller, An Introduction to Probability Theory and its Applications, Vol.1, 3rd Ed., Wiley, 1968.
5. N.P. Bali and Manish Goyal, A text book of Engineering Mathematics,Laxmi Publications, Reprint,
6. B.S. Grewal, Higher Engineering Mathematics, Khanna Publishers, 35thEdition, 2000.

Methodology

The course will be covered through lectures.

@The CO-PO Mapping Matrix

CO\ PO	PO1	PO2	PO3	PO4	PO 5	PO6	PO7	PO 8	PO9	PO1 0	PO1 1	PO 12
CO	1	1	2	1	-	-	-	-	-	-	-	-
CO 2	1	2	-	2	-	-	-	-	-	-	-	-
CO 3	2	1	2	1	-	-	-	-	-	-	-	-
CO 4	1	2	-	2	-	-	-	-	-	-	-	-
CO 5	-	-	2	-	-	-	-	-	-	-	-	-
CO 6	-	2	1	2	-	-	-	-	-	-	-	-
Co7	1	2	2	-	-	-	-	-	-	-	-	-

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BSC 202: General Biology

Teaching Scheme	Credit Scheme	Examination Scheme and Marks
Lecture: 02 Hours/Week	02	Internal Assessment (TH): 20 Marks End Semester (TH): 30 Marks

Course Objective:

The objective of this course is to familiarize the students with basic conceptsin biology.

Course Outcomes:

After studying the course, the student will be able to:

CO1: Describe how biological observations of 18th Century that lead to majordiscoveries

CO2:Convey that classification per se is not what biology is all about but highlight the underlying criteria, such as morphological, biochemical andecological

CO3: Highlight the concepts of recessiveness and dominance during thepassage of genetic material from parent to offspring

CO4: Convey that all forms of life have the same building blocks and yet themanifestations are as diverse as one can imagine

CO5: Classify enzymes and distinguish between different mechanisms ofenzyme action.

CO6: Identify DNA as a genetic material in the molecular basis of informationtransfer.

CO7: Analyze biological processes at the reductionistic level.

CO8: Identify and classify microorganisms.

CO9: Study of identification and classification of microbiology.

Prerequisites:

Basic school level knowledge in Biology.

Unit I	Introduction	(04 Hours)
Mention the most exciting aspect of biology as an independent scientific discipline. Why we need to study biology? Discuss how biological observations of 18th Century that leadto major discoveries.		
Mapping of Course Outcomes	CO1	
Unit II	**Classification**	**(04 Hours)**
Discuss classification based on (a)cellularity Unicellular or multicellular (b) ultrastructure prokaryotes oreukaryotes. (c) energy and Carbonutilization -Autotrophs, heterotrophs,lithographs (d) Ammonia excretion –aminotelic, uricotelic, ureotelic (e) Habitata- aquatic or terrestrial (e) Molecular taxonomy		

Mapping of Course Outcomes	CO2	
Unit III	**Genetics**	**(02 Hours)**
Concept of allele. Gene mapping, Geneinteraction, Epistasis. Meiosis and Mitosis be taught as a part of genetics. Phases how genetic material passes from parent to offspring.		
Mapping of Course Outcomes	CO3	
Unit IV	**Biomolecules**	**(04 Hours)**
Discuss monomeric units and polymericstructures. Discuss about sugars, starch and cellulose. Amino acids and proteins. Nucleotides and DNA/RNA. Two carbon units and lipids.		
Mapping of Course Outcomes	CO4	
Unit V	**Enzymes**	**(02 Hours)**
How to monitor enzyme catalyzedreactions. How does an enzyme catalyze reactions. Enzymeclassification. Mechanism of enzyme action. Enzyme kinetics and kinetic parameters. RNA catalysis.		
Mapping of Course Outcomes	CO5	
Unit VI	**Information Transfer**	**(04 Hours)**
DNA as a genetic material. Hierarchy ofDNA structure from single stranded to double helix to nucleosomes. Concept of genetic code.		
Mapping of Course Outcomes	CO6	
Unit VII	**Macromolecular Analysis**	**(04 Hours)**
Proteins- structure and function.Hierarch in protein structure. Primary secondary, tertiary and quaternarystructure. Proteins as enzymes, transporters, receptors and structural elements.		
Mapping of Course Outcomes	CO7	
Unit VIII	**Metabolism**	**(01 Hours)**
Exothermic and endothermic versusendergonic and exergonic reactions.Concept of Keq and its relation to Standard free energy. Spontaneity. ATPas an energy currency.		
Mapping of Course Outcomes	CO8	
Unit IX	**Microbiology**	**(01 Hours)**
Concept of single celled organisms. Concept of species and strains. Identification and classification of Microorganisms. Microscopy.		

Mapping of Course Outcomes	CO9

Reference Books:

1) Biology: A global approach: Campbell, N. A.; Reece, J. B.; Urry, Lisa; Cain, M, L.; Wasserman, S. A.; Minorsky, P. V.; Jackson, R. B. Pearson Education Ltd
2) Outlines of Biochemistry, Conn, E.E; Stumpf, P.K; Bruening, G; Doi, R.H., John Wiley and Sons
3) Principles of Biochemistry (5th Edition), By Nelson, D. L.; and Cox, M. M.W.H. Freeman and Company
4) Molecular Genetics (Second edition), Stent, G. S.; and Calender, R.W.H. Freeman and company, Distributed by Satish Kumar Jain for CBS Publisher
5) Microbiology, Prescott, L.M J.P. Harley and C.A. Klein 1995. 2nd edition Wm, C. Brown Publishers

Methodology

The course will be covered through lectures and tutorials

@The CO-PO Mapping Matrix

CO\ PO	PO1	PO2	PO3	PO4	PO 5	PO6	PO7	PO 8	PO9	PO1 0	PO1 1	PO 12
CO	1	1	2	1	-	-	-	-	-	-	-	-
CO 2	1	2	-	2	-	-	-	-	-	-	-	-
CO 3	2	1	2	1	-	-	-	-	-	-	-	-
CO 4	1	2	-	2	-	-	-	-	-	-	-	-
CO 5	-	-	2	-	-	-	-	-	-	-	-	-
CO 6	-	2	1	2	-	-	-	-	-	-	-	-
Co7	1	2	2	-	-	-	-	-	-	-	-	-

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ESC 202: Engineering Graphics & Designing

Teaching Scheme	Credit Scheme	Examination Scheme and Marks
Lecture: 01 Hours/Week	03	Internal Assessment (TH): 40 Marks
Practical: 04 Hours/Week		End Semester (TH): 60 Marks

Course Objective:

Objective of the course are: To Learn basic engineering drawing formats. Learn to take data and transform it into graphics drawings. Learn to sketch andtake field dimensions.

Course Outcomes:

On completion of the course, learner will be able to

CO1: Draw the fundamental engineering objects using basic rules and be able toconstruct the simple geometries.

CO2: Construct the various engineering curves using the drawing instruments.

CO3: Apply the concept of orthographic projection of an object to draw several2D views and its sectional views for visualizing the physical state of the object.

CO4: Apply the visualization skill to draw a simple isometric projection from given orthographic views precisely using drawing equipment.

CO5: Draw the development of lateral surfaces for cut sections of geometrical solids.

CO6: Introduction to development of lateral surfaces and its industrial applications.

Prerequisites:

Since the course is very basic in nature, knowledge of mathematics is required.

Unit I	Fundamentals of Engineering Drawing	(04 Hours)
Need of Engineering Drawing anddesign, Sheet layout, Line types and dimensioning and simple geometrical constructions.		
Mapping of Course Outcomes	CO1	

Unit II	Introduction to 2D and 3D computer aided drafting packages	(06 Hours)
Evolution of CAD, Importance of CAD,Basic Commands - Edit, View, Insert, Modify, Dimensioning Commands, setting and tools etc. and its applications to construct the 2D and 3D drawings		
Mapping of Course Outcomes	CO2	

Unit III	Engineering Curves	(05 Hours)
Introduction to conic sections and itssignificance, various methods to construct the conic sections. Helix for cone and cylinder , rolling curves (Involutes , Cycloid) and Spiral		
Mapping of Course Outcomes	CO3	
Unit IV	**Orthographic Projection**	**(04 Hours)**
Principle of projections, Introduction to First and Third angle Projection methods, Orthographic projection of point, line, plane, solid and machine elements/parts		
Mapping of Course Outcomes	CO4	
Unit V	**Isometric Projection**	**(06 Hours)**
Introduction to isometric projection,oblique projection and perspectiveprojection. Draw the isometricprojection from the given orthographic views		
Mapping of Course Outcomes	CO5	
Unit VI	**Development of Lateral Surfaces**	**(05 Hours)**
Introduction to development of lateral surfaces and its industrial applications. Draw the development of lateral surfacesfor cut section of cone, pyramid, prism etc.		
Mapping of Course Outcomes	CO6	

Text Books:

1. Bhatt, N. D. and Panchal, V. M., (2016), Engineering Drawing‖, CharotarPublication, Anand, India
2. K. Venugopal, K, (2015), Engineering and Graphics‖, New AgeInternational, New Delhi
3. Jolhe, D. A., (2015), Engineering Drawing with introduction to AutoCAD,Tata McGraw Hill, New Delhi
4. Rathnam, K., (2018), A First Course in Engineering Drawing‖, Springer Nature Singapore Pte. Ltd., Singapore

Reference Books:

1. Madsen, D. P. and Madsen, D. A., (2016), Engineering Drawing and design, Delmar Publishers Inc., USA
2. Bhatt, N. D., (2018), Machine Drawing, Chartor Publishing house, Anand,India
3. Dhawan, R. K., (2000), A Textbook of Engineering Drawing, S. Chand, New Delhi
4. Luzadder, W. J. and Duff, J. M., (1992), The Fundamentals of Engineering Drawing: With an Introduction to Interactive Computer Graphics forDesign and Production, Peachpit Press, USA
5. Giesecke, F. E., Mitchell, A., Spencer, H. C., Hill, I. L., Loving, R. O., Dygon, J. T., (1990), Principles of engineering graphics, McMillan Publishing, USA
6. Jensen, C., Helsel, J. D., Short, D. R., (2008), Engineering Drawing and Design‖, McGraw-Hill International, Singapore Guidelines for L

Practical's:

a. Draw minimum two problems on each assignment on the A3 size drawingsheet.
b. Suggested List of Laboratory Experiments/Assignments Assignment
c. Construct any Engineering Curve by any method Assignment
d. Orthographic view of any machine element along with sectional view.Assignment
e. Draw Isometric view for given orthographic views. Assignment
f. Draw the development of lateral surface of a solid/ truncated solid Assignment
g. Draw the isometric or Orthographic view of a product/object (For exampleWorkshop Job prepared during the workshop practice or any product developed during the first year session.)

Methodology

The course would be taught through lectures, demonstrations, and practicals.

@The CO-PO Mapping Matrix

CO\ PO	PO1	PO2	PO3	PO4	PO 5	PO6	PO7	PO 8	PO9	PO1 0	PO1 1	PO 12
CO	1	1	2	1	-	-	-	-	-	-	-	-
CO 2	1	2	-	2	-	-	-	-	-	-	-	-
CO 3	2	1	2	1	-	-	-	-	-	-	-	-
CO 4	1	2	-	2	-	-	-	-	-	-	-	-
CO 5	-	-	2	-	-	-	-	-	-	-	-	-
CO 6	-	2	1	2	-	-	-	-	-	-	-	-
Co7	1	2	2	-	-	-	-	-	-	-	-	-

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BT 203: Engineering Mechanics

Teaching Scheme	Credit Scheme	Examination Scheme and Marks
Lecture: 03 Hours/Week	03	Internal Assessment (TH): 40 Marks End Semester (TH): 60 Marks

Course Objective:

The objective of the course is to familiarize the students with the basic conceptsof engineering mechanics.

Course Outcomes:

CO1: At the end of the course the students will have sufficient knowledge ofmechanical engineering techniques which will help them to implement them in the life sciences.

CO2: Principle of statics, Force system, Resolution and composition of forces, Resultant of concurrent, forces.

CO3: Types of beams, simple and compound beams, Type of supports andreaction.

CO4: Understand Simple Contact friction, Rolling Resistance & Belt Friction

CO5: Basic Concepts Equation of motion in Cartesian coordinates.

CO6: understand the kinetics Work, power, and energy conservative.

Prerequisites:

Since the course is technical in nature the students must have the basicknowledge of Math sans Physics.

Unit I	**Module 1**	**(06 Hours)**
Introduction, Units and Dimensions, Laws of Mechanics, Vectors – Victorian representationof forces and moments, Vector operations		
Mapping of Course Outcomes	CO1	
Unit II	**Module 2**	**(08 Hours)**
Principle of statics, Force system, Resolution and composition of forces, Resultant of concurrent, forces. Moment of a force, Varignon's theorem, resultant of parallel forcesystem, Couple, Equivalent force couple system, Resultant of parallel general force system		
Mapping of Course Outcomes	CO2	
Unit III	**Module 3**	**(08 Hours)**
Free body diagram Equilibrium of concurrent, parallel forces in a plane Equilibrium of general forces in a plane Equilibrium of three forces in a plane, Types of beams, simple and compound beams, Type of supports andreaction, Forces in space, Resultant of concurrent and parallel forces in a space, Equilibrium of concurrent and parallel forces in a space.		

Mapping of Course Outcomes	CO3	
Unit IV	**Module 4**	**(04 Hours)**
Frictional Force, Laws of Coulomb friction,Simple Contact friction, Rolling Resistance & Belt Friction		
Mapping of Course Outcomes	CO4	
Unit V	**Module 5**	**(07 Hours)**
Kinematics of linear motion- Basic concepts Equation of motion for constant acceleration Motion under gravity, Variable accelerationmotion curves. Kinematics of curvilinear motion- Basic Concepts Equation of motion inCartesian coordinates Equation of motion in path coordinates Equation of motion in polar coordinates Motion of projectile.		
Mapping of Course Outcomes for Unit V	CO5	
Unit VI	**Module 6**	**(07 Hours)**
Kinetics- Newton‘s Second Law of motion Application of Newton‘s Second Law. Work, power, energy, conservative and non- conservative forces Conservation of energy formotion of particle, Impulse, Momentum, Direct central impact. Coefficient of restitution, Impulse Momentum principle ofparticle.		
Mapping of Course Outcomes	CO6	

Reference Book:

1. Engineering Mechanics, 2nd ed. — MK Harbola
2. Introduction to Mechanics — MK Verma
3. An Introduction to Mechanics — D Kleppner & R Kolenkow
4. Principles of Mechanics — JL Synge & BA Griffiths
5. Mechanics — JP Den Hartog
6. Engineering Mechanics - Dynamics, 7th ed. - JL Meriam
7. Mechanical Vibrations — JP Den Hartog
8. Theory of Vibrations with Applications — WT Thomson

Methodology:

The course will be covered through lectures supported by practicals.

@The CO-PO Mapping Matrix

CO\ PO	PO1	PO2	PO3	PO4	PO 5	PO6	PO7	PO 8	PO9	PO1 0	PO1 1	PO 12
CO	1	1	2	1	-	-	-	-	-	-	-	-
CO 2	1	2	-	2	-	-	-	-	-	-	-	-
CO 3	2	1	2	1	-	-	-	-	-	-	-	-
CO 4	1	2	-	2	-	-	-	-	-	-	-	-
CO 5	-	-	2	-	-	-	-	-	-	-	-	-
CO 6	-	2	1	2	-	-	-	-	-	-	-	-
Co7	1	2	2	-	-	-	-	-	-	-	-	-

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ESC 204: Project Based Learning -I

Teaching Scheme	Credit Scheme	Examination Scheme and Marks
Practical: 04 Hours/Week	02	Internal Assessment (TH): 40 Marks End Semester (TH): 60 Marks

Course Objective

1. To emphasizes learning activities that are long-term, interdisciplinary andstudent-centric.
2. To inculcate independent learning by problem solving with social context.
3. To engages students in rich and authentic learning experiences.
4. To provide every student the opportunity to get involved either individually or as a group so as to develop team skills and learn professionalism.

Course Outcomes:

CO1: Project based learning will increase their capacity and learning through shared cognition.

CO2: Students able to draw on lessons from several disciplines and apply them in practical way.

CO3: Learning by doing approach in PBL will promote long-term retention of material and replicable skill, as well as improve teachers' and students' attitudes towards learning.

Group Structure:

Working in supervisor/mentor –monitored groups. The students plan, manageand complete a task/project/activity which addresses the stated problem.

- There should be team/group of 5 -6 students
- A supervisor/mentor teacher assigned to individual groups

Selection of Project/Problem:

The problem-based project-oriented model for learning is recommended. The model begins with the identifying of a problem, often growing out of a questionor ―wondering. This formulated problem then stands as the starting point forlearning. Students design and analyze the problem within an articulated interdisciplinary or subject frame.

A problem can be theoretical, practical, social, technical, symbolic, cultural and/or scientific and grows out of students ‘wondering within different disciplines and professional environments. A chosen problem has to be exemplary. The problem may involve an interdisciplinary approach in both theanalysis and solving phases.

By exemplarity, a problem needs to refer back to a particular practical,scientific, social and/or technical domain. The problem should stand as one specific example or manifestation of more general learning outcomes related to knowledge and/or modes of inquiry.

There are no commonly shared criteria for what constitutes an acceptable project. Projects vary greatly in the depth of the questions explored, the clarityof the learning goals, the content and structure of the activity.

- A few hands-on activities that may or may not be multidisciplinary
- Use of technology in meaningful ways to help them investigate,collaborate, analyze, synthesize and present their learning.
- Activities may include- Solving real life problem, investigation /studyand Writing reports of in depth study, field work.

The institution/head/mentor is committed to assessing and evaluating both student performance and program effectiveness.

Progress of PBL is monitored regularly on weekly basis. Weekly review of thework is necessary. During process of monitoring and continuous assessment AND evaluation the individual and team performance is to be measured. PBL is monitored and continuous assessment is done by supervisor /mentor and authorities.

Students must maintain an institutional culture of authentic collaboration, self-motivation, peer-learning and personal responsibility. The institution/ department should support students in this regard through guidance/orientationprograms and the provision of appropriate resources and services. Supervisor/mentor and Students must actively participate in assessment and evaluation processes.

Group may demonstrate their knowledge and skills by developing a public product and/or report and/or presentation.

- Individual assessment for each student (Understanding individual capacity, role and involvement in the project) Group assessment (rolesdefined, distribution of work, intra-team communication and togetherness) Documentation and presentation Evaluation and Continuous Assessment:

It is recommended that the all activities are to be record and regularly, regularassessment of work to be done and proper documents are to be maintained at college end by both students as well as mentor (you may call it PBL work book).

Continuous Assessment Sheet (CAS) is to be maintained by all mentors/department and institutes

- Recommended parameters for assessment, evaluation and weightage:Idea Inception **(5%)**
- Outcomes of PBL/ Problem Solving Skills/ Solution provided/ Final product **(50%)** (Individual assessment and team assessment)
- Documentation (Gathering requirements, design & modeling, implementation/execution, use of technology and final report, other documents) **(25%)**
- Demonstration (Presentation, User Interface, Usability etc) **(10%)**
- Contest Participation/ publication **(5%)**
- Awareness /Consideration of -Environment/ Social /Ethics/ Safety measures/Legal aspects **(5%)**

PBL workbook will serve the purpose and facilitate the job of students,mentor and project coordinator. This workbook will reflect accountability,punctuality, technical writing ability and work flow of the work undertaken.

Reference Book:

- Project-Based Learning, Edutopia, March 14, 2016. What is PBL?Buck Institute for Education.
- www.schoology.com
- www.wikipedia.org
- www.howstuffworks.com

@The CO-PO Mapping Matrix

CO\ PO	PO1	PO2	PO3	PO4	PO 5	PO6	PO7	PO 8	PO9	PO1 0	PO1 1	PO 12
CO	1	1	2	1	-	-	-	-	-	-	-	-
CO 2	1	2	-	2	-	-	-	-	-	-	-	-
CO 3	2	1	2	1	-	-	-	-	-	-	-	-
CO 4	1	2	-	2	-	-	-	-	-	-	-	-
CO 5	-	-	2	-	-	-	-	-	-	-	-	-
CO 6	-	2	1	2	-	-	-	-	-	-	-	-
Co7	1	2	2	-	-	-	-	-	-	-	-	-

Dr. D. Y. Patil School of Science &Technology,
Dr. D. Y. Patil Vidyapeeth, Pimpri, Pune

ESC 205: Workshop & Manufacturing

Teaching Scheme	Credit Scheme	Examination Scheme and Marks
Practical: 04 Hours/Week	02	Internal Assessment (TH): 40 Marks End Semester (TH): 60 Marks

Course Objective

1. To understand the construction and working of machine tools and functions of its parts.
2. To develop the skill through hands-on practices using hand tools, power tools, machine tools in manufacturing and assembly shops leading to understanding of production processes.
3. To understand workshop layout and safety norms.

Course Outcomes:

Upon completion of this course, the students will gain knowledge of the different manufacturing processes which are commonly employed in theindustry, to fabricate components using different materials**.**

Prerequisites:

This subject requires basic knowledge of Mathematics & Engineering Graphics.

Course Description: Practical Details

***Minimum eight experiments to be conducted out of 10.**

1. Mandatory briefing on shop-floor safety
2. Demonstration and working of center lathe, Demonstration on various functions of lathe parts: Headstock, Tailstock, Carriage, Lead screw, All geared Mechanism, Apron mechanism etc.
3. Demonstration of Lathe operations: Step turning and facing, drilling operation on a Mild Steel cylindrical job on center lathe. Understanding the concept of speed, feed and depth of cut.
4. Demonstration of Drilling machine Demonstration on construction of Radial drilling machine, Tool holding devices, Concept of speed, feed anddepth of cut.
5. Demonstration on Milling machine Demonstration on construction, table movements, indexing and tooling of milling machine.
6. Demonstration of Shaper/Grinding machine (Any one) Shaper: Crank andslotted link mechanism, Work feed mechanism Grinding: Surface grinder/Cylindrical grinding machine, Mounting of grinding wheel
7. Term work includes one job of Carpentry Introduction to woodworking, kinds of woods, hand tools & machines, Types of joints, wood turning. Pattern making, types of patterns and its allowances.

8. Term work to include one job involving fitting to size, male-female fittingwith drilling and tapping operation on Mild Steel plate; Introduction to marking, cutting and sawing, sizing of metal, shearing, Concept of fits andinterchangeability, selection of datum and measurements.
9. Term work to include one utility job preferably using sheet metal (e.g. Tray, Funnel etc.) with riveting/welding/brazing/soldering (at least one temporary and one Permanent joint either using resistance welding/Arc welding); Introduction to sheet metal operations: punching, blanking,bending, drawing.
10. Prepare a Layout of the workshop.
11. Collection of information about safety norms in any one of the following type of industry: Metalworking/Chemical/Cement/Pharmaceuticals/Defense/Atomic energy/Aerospace/Marine/Construction/Railway etc.

Methodology:

The course will be covered through practicals supported by the theoreticalpart.

Reference Book:

1. John, K. C., (2010), Mechanical Workshop Practice, Prentice Hall Publication, New Delhi
2. Hazra and Chaudhary, Workshop Technology-I & II, Media promoters &Publisher Pvt. Ltd

@The CO-PO Mapping Matrix

CO\ PO	PO1	PO2	PO3	PO4	PO 5	PO6	PO7	PO 8	PO9	PO1 0	PO1 1	PO12
CO	1	1	2	1	-	-	-	-	-	-	-	-
CO 2	1	2	-	2	-	-	-	-	-	-	-	-
CO 3	2	1	2	1	-	-	-	-	-	-	-	-
CO 4	1	2	-	2	-	-	-	-	-	-	-	-
CO 5	-	-	2	-	-	-	-	-	-	-	-	-
CO 6	-	2	1	2	-	-	-	-	-	-	-	-
Co7	1	2	2	-	-	-	-	-	-	-	-	-

SEMESTER - III

SEMESTER III						
Course Code	**Course Name**	**L**	**T**	**P**	**Hr**	**Cr**
BSC 301	**Discrete Structure**	**3**	**0**	**0**	**3**	**3**
PCC-AI 301	**Data Structures and Algorithms**	**3**	**0**	**4**	**7**	**5**
PCC-AI 302	**Software Engineering & Project Management**	**3**	**0**	**4**	**7**	**5**
PCC-AI 303	**Database Management Systems**	**3**	**0**	**4**	**7**	**5**
PCC-AI 304	**Project Based Learning-II**	**0**	**1**	**4**	**5**	**3**
HSMC 201	**Universal Human Values-II**	**2**	**1**	**0**	**3**	**3**
Total		**14**	**2**	**16**	**32**	**24**

Dr D. Y. Patil School of Science & Technology,
Dr D. Y. Patil Vidyapeeth, Pimpri, Pune

BSC 301: Discrete Structure

Teaching Scheme	Credit Scheme	Examination Scheme and Marks
Lecture: 03 Hours/Week	03	Internal Assessment (TH): 40 Marks
Practical: 00 Hours/Week		End Semester (TH): 60 Marks

Course Objective:

1. To learn the fundamental concepts like set, relations, functions, graph, coding theory.
2. To understand the related operations and terminologies in context of problem by applying suitable set, function, and relation models to real instances.
3. To use simple programming statements and expressions to demonstrate different solutions/approach.
4. To understand use of set theory, graph theory, algebraic structure.
5. To formulate the problems, solve them, use formal proof techniques, and explain reasoning.
6. Apply recursive functions and solve recurrence relations
7. To learn to express algorithmic ideas mathematically.

Course Outcomes:

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

CO1: To identify set, discrete numerical functions.

CO2: To understand the various properties of algebraic structures.

CO3: To apply combinatorial problems using basic computing principles.

CO4: To determine critical thinking, analytical reasoning, and problem-solving abilities.

CO5: To interpret data and solve problems, use appropriate mathematical and statistical concepts and operations.

CO6: To apply set, proposition in problem solving.

CO7: To utilize algebraic structure in solving real world problem

Prerequisites

Basic knowledge of fundamental mathematics is required.

Unit I	Sets and Propositions	(8 Hours)
Sets, set combinations, finite and infinite sets, countably infinite sets, inclusion and exclusion principle, multi-sets Propositions, Conditional Propositions, Logical Connectivity, Prepositional Calculus, Universal and Existential Quantifiers, Standard Forms, Proof Methods, Mathematical Induction		
Mapping of Course Outcomes	CO1	
Unit II	**Relations and Functions**	**(07 Hours)**
Binary Relationship Properties, Relationship severance Warshall's algorithm, Job scheduling problem using discrete numeric functions and generating functions. Homogeneous Solutions, Linear Recurrence Relations with Constant Coefficients, and Recurrence Relations.		
Mapping of Course Outcomes	CO2	
Unit III	**Algebraic structures**	**(08 Hours)**

Home

The structure of algebra, Algebraic Systems, Semi Groups, Monoids, Groups, Homomorphism and Normal Subgroups, and Congruence relations, Rings, Integral Domains and Fields, Graphs and their properties – Degree, Connectivity, Path, Cycle – Sub Graph –Isomorphism – Eulerian and Hamiltonian Walks –Rooted Trees, Trees and Sorting.		
Mapping of Course Outcomes	CO3	
Unit IV	**Graph Theory**	**(08 Hours)**
Basic terminology, graph representation in computer memory, multi-graphs and weighted graphs, Subgraphs, Isomorphic graphs Operations on graphs, paths and circuits, Hamiltonian and Euler paths and circuits, shortest path in weighted graphs (Dijkstra's algorithm), factors of a graph, planer graph and Traveling salesman problem, Graph Coloring		
Mapping of Course Outcomes	CO4	
Unit V	**Trees**	**(07 Hours)**
Basic terminology and characterization of trees, Prefix codes and optimal prefix codes, binary search trees, Tree traversal, spanning trees, Fundamental Trees and cut sets, Minimal Spanning trees, Kruskal's and Prim's algorithms for minimal spanning trees, The Max flowMin Cut Theorem (Transport network).		
Mapping of Course Outcomes	CO5	
Unit VI	**Coding Theory**	**(05 Hours)**
Coding theory, Polynomial Rings and polynomial Codes, Galois Theory –Field Theory and Group Theory.		
Mapping of Course Outcomes	CO6, CO7	
Learning Resources		

Methodology

The course will be covered through lectures Chalk & Board, videos and PPT.

Reference Books:

1. Kenneth H. Rosen, "**Discrete Mathematics and its Applications: with Combinatorics and Graph Theory**", 7th Edition, Tata McGraw –Hill Education Pvt. Ltd., 2015.
2. J.P. Tremblay and R. Manohar, "**Discrete Mathematical Structure with Applications to Computer Science**", Tata Mc Graw Hill Education (India) Edition 1997.
3. Norman L. Biggs, "**Discrete Mathematics**", 2nd Edition, Oxford University
4. Narsingh Deo, "**Graph theory with applications to Engineering and Computer Science**", Prentice Hall Inc., Englewood Cliffs,N.J., 1974.
5. Susanna S. Epp, "**Discrete Mathematics with Applications**", 4th edition, Brooks/Cole, Cengage Learning, 2010.

@The CO-PO Mapping Matrix

CO\ PO	PO1	PO2	PO3	PO4	PO 5	PO6	PO7	PO 8	PO9	PO1 0	PO1 1	PO 12
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CO 3	2	1	2	1	-	-	-	-	-	-	-	-
CO 4	1	2	-	2	-	-	-	-	-	-	-	-
CO 5	-	-	2	-	-	-	-	-	-	-	-	-
CO 6	-	2	1	2	-	-	-	-	-	-	-	-

Dr. D. Y. Patil School of Science &Technology,
Dr. D. Y. Patil Vidyapeeth, Pimpri, Pune

PCC-AI 301: Data Structures & Algorithms

Teaching Scheme	Credit Scheme	Examination Scheme and Marks
Lecture: 03 Hours/Week	05	Internal Assessment (TH): 40 Marks
Practical: 04 Hours/Week		End Semester (TH): 60 Marks

Course Objective:

1. To understand the basic concepts in data structure.
2. To discuss various algorithmic strategies to solve real life problems.
3. To acquaint the learner various data searching and sorting techniques.
4. To identify and use the appropriate data structure for various real life problems using computer languages.
5. To understand the concepts of linear, non-linear data structures with its complexities.
6. To understand and efficiently apply various data structures such as stacks, queues, linked lists, trees and graphs for solving various computing problems using Python programming language.

Course Outcomes:

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

CO1: To understand the need of data structures.
CO2: To learn to apply the algorithm complexity techniques for various estimations.
CO3: To use organised data structure to solve various problem statements.
CO4: To develop the solutions to social issues using NP Complete theory using Python
CO5: To distinguish the use of various structures in solving problems.
CO6: To understand the usage of appropriate data structures to implement algorithms.

Prerequisites:

Students must have knowledge of programming language, basics of mathematics and ability to solve problem. Students also must have a good command on C & Python Programming.

Unit I	Introduction to Data Structure and Algorithms	(06 Hours)
Algorithm characteristics, Algorithm design tools, pseudo code and flowchart, Asymptotic notations complexity Recursion and iteration, recurrence equation, Master's theorem recurrence relationships. Need of Data Structure, Types of Data Structure and Abstract Data types.		
Mapping of Course Outcomes	CO1	
Unit II	**Linear Data Structures**	**(08 Hours)**
Arrays based Linear Data Structure: Array storage, sparse arrays; Transpose, addition, and multiplication of sparse matrices, Stacks and Queues and their applications, multiple stacks, queues in an array.		
Mapping of Course Outcomes	CO2	
Unit III	**Non-Linear Data Structures**	**(08 Hours)**

Singly, Doubly & Circular Linked Lists; representation, operations, applications, linked stacks and queues. linked lists based polynomial addition		
Mapping of Course Outcomes	CO3	
Unit IV	**Advanced Data Structures**	**(07 Hours)**
Trees, Basic concepts and definitions of a tree and binary tree and associated terminology, Binary tree traversal techniques, some more operations on binary trees, Heaps, heapsort.		
Mapping of Course Outcomes	CO4	
Unit V	**Searching & Sorting Techniques**	**(08 Hours)**
Searching techniques: Linear and Binary Search techniques, Sorting techniques: Insertion, Selection, Bubble, Merge sort, Quicksort.		
Mapping of Course Outcomes	CO5	
Unit VI	**NP–Hard and NP Complete Problems**	**(08 Hours)**
Definitions, Cook's Theorem, NP complete Problems, NP Hard Scheduling problems, Case studies		
Mapping of Course Outcomes	CO6	

Methodology

The course will be covered through lectures and supported by practical.

Reference Books:

1. E Horowitz and S. Sahni: Fundamentals of Data Structures in C, Second Edition, Universities Press, Hyderabad.
2. R.L. Kruse: Data Structures & Program Design in C, PHI.
3. D.F. Knuth: The art of Computer Programming Vol 1, Narosa Publications, 1985.
4. Byron S. Gottfried & J K Chhabra: Theory and Problems of Programming with C Language, Schaum's Outlines Series, TMH, 2005.
5. David Griffiths, Introduction to Electrodynamics, 3rd edition, 1999, Prentice Hall
6. David Griffiths, Introduction to Quantum Mechanics, 2nd edition, 2005, Prentice Hall
7. Y Daniel Liang, "Introduction to Programming using Python", Pearson.
8. Benjamin Baka, David Julian, "Python Data Structures and Algorithms", Packt Publishers,2017.
9. Rance D. Necaise, "Data Structures and Algorithms using Python", Wiley Student Edition.
10. Martin Jones, "Python for Complete Beginners", 2015.

Practicals:

1. Write Python programs for implementing the following searching techniques. a. Linear search b. Binary search c. Fibonacci search
2. Write Python programs for implementing the following sorting techniques to arrange a list of integers in ascending order. a. Bubble sort b. Insertion sort c. Selection sort
3. Write Python programs for implementing the following sorting techniques to arrange a list of integers in ascending order. a. Quick sort b. Merge sort
4. Write Python programs to a. Design and implement Stack and its operations using List. b. Design and implement Queue and its operations using List.
5. Write Python programs for the following: a. Uses Stack operations to convert infix expression into postfix expression. b. Uses Stack operations for evaluating the postfix expression
6. Write Python programs for the following operations on Single Linked List. (i) Creation (ii) insertion (iii) deletion (iv) traversal b. To store a polynomial expression in memory using single linked list
7. Write Python programs for the following operations on Circular Linked List. (i) Creation (ii) insertion (iii) deletion (iv) traversal
8. Write Python programs for the following: Uses functions to perform the following operations on Double Linked List. (i) Creation (ii) insertion (iii) deletion (iv) traversal in both ways
9. Write a Python program to implement Stack using linked list.
10. Write a Python program to implement Linear Queue using linked list
11. Write Python programs to implement the following graph traversal algorithms: a. Depth first search. b. Breadth first search
12. Write a Python program to perform the following: a. Create a binary search tree. b. Traverse the above binary search tree recursively in pre-order, post-order and in-order. c. Count the number of nodes in the binary search tree

@The CO-PO Mapping Matrix

CO\ PO	PO1	PO2	PO3	PO4	PO 5	PO6	PO7	PO 8	PO9	PO1 0	PO1 1	PO 12
CO	1	1	2	1	-	-	-	-	-	-	-	-
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CO 3	2	1	2	1	-	-	-	-	-	-	-	-
CO 4	1	2	-	2	-	-	-	-	-	-	-	-
CO 5	-	-	2	-	-	-	-	-	-	-	-	-
CO 6	-	2	1	2	-	-	-	-	-	-	-	-
Co7	1	2	2	-	-	-	-	-	-	-	-	-

Dr. D. Y. Patil School of Science &Technology,
Dr. D. Y. Patil Vidyapeeth, Pimpri, Pune

PCC-AI 302: Software Engineering & Project Management

Teaching Scheme	Credit Scheme	Examination Scheme and Marks
Lecture: 03 Hours/Week	05	Internal Assessment (TH): 40 Marks
Practical: 04 Hours/Week		End Semester (TH): 60 Marks

Course Objective:

1. To understand the fundamental of software engineering
2. To discuss about the requirement analysis and design using various tools.
3. To differentiate the role of software developer and software tester.
4. To illustrate the use of COCOMO models for projects cost estimation.
5. To provide a working knowledge of estimating, design, testing, and quality management strategies for big software development projects.
6. To conceptualize the Software Development Life Cycle (SDLC) models.

Course Outcomes:

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

CO1: To understand the need of software engineering and its various models.

CO2: To interpret the phases of Software Development using agile methodology.
CO3: To classify various Lifecycle models, requirement analysis and specifications.
CO4: To understand preparation of SRS document, Design Concepts.

CO5: To understand and demonstrate software coding, software testing for a given set of problem

CO6: To familiarize Project Management framework and Tools.

CO7: To apply Unified Modelling Language to transform end-user needs into system and software requirements, and to structure the requirements in a Software Requirements Document (SRD).

Prerequisites:

Students must have a knowledge of fundamentals of software programming.

Unit I	**Introduction**	**(07 Hours)**
Importance and Emergence of Software Engineering Feasibility Study, Requirement Analysis, Design, Implementation, Testing, and Maintenance phases of software development Software Life Cycle Models: Waterfall, Iterative, Prototyping, Spiral, and Agile - Compare and contrast life cycle models.		
Mapping of Course Outcomes	CO1	
Unit II	**Requirements Analysis and Design**	**(08 Hours)**
Process of analysis, Requirement specification, ideal SRS properties, SRS document structure, etc. Diagrams of Data Flow - Software Architecture and Architecture Views: What Role Do They Play? - Software Project Planning Software Design - Software Design Concepts - Complexity Metrics for Function-Oriented Design - Complexity Metrics for Object-Oriented Design - A well-thought-out design. Use Case Approach. SRS Case study, Software Estimation: Size Estimation: Function Point (Numerical). Cost Estimation: COCOMO (Numerical), COCOMO-II (Numerical). Types of Requirements, Feasibility Study, Requirement Analysis and Design: DFD, Data Dictionary		

Home

Mapping of Course Outcomes	CO2	
Unit III	**Software Project Planning & Management**	**(06 Hours)**
Business Case, Project selection and Approval, Project charter, Project Scope management: Scope definition and Project Scope management, Creating the Work Breakdown Structures, Scope Verification, Scope Control, Methods for estimating project time and cost, Resource Management,		
Mapping of Course Outcomes	CO3	
Unit IV	**Project Scheduling**	**(08 Hours)**
Relationship between people and Effort: Staffing Level Estimation, Effect of schedule Change on Cost, Degree of Rigor & Task set selector, Project Schedule, Schedule Control, CPM (Numerical), Basic Planning Purchases and Acquisitions, Planning Contracting, Requesting Seller Responses, Selecting Sellers, Outsourcing: The Beginning of the outsourcing phenomenon, Types of outsourcing relationship		
Mapping of Course Outcomes	CO4	
Unit V	**Agile Methodology**	**(07 Hours)**
Theories for Agile Management – Agile Software Development – Traditional Model vs. Agile Model - Classification of Agile Methods – Agile Manifesto and Principles – Agile Project Management – Agile Team Interactions – Ethics in Agile Teams		
Mapping of Course Outcomes	CO5	
Unit VI	**Business Continuity & Disaster Management**	**(07 Hours)**
Introduction to Disaster Recovery and Business Continuity, Nature and Causes of Disasters, Business Continuity Management, Disaster Recovery Planning Process		
Mapping of Course Outcomes	CO6	

Methodology:

The course will be covered through lectures and supported by practical.

Reference Books:

1. **Software Engineering**, 5th and 7th edititon, by Roger S Pressman, McGraw Hill publication.
2. **Managing Information Technology Project**, 6edition, by Kathy Schwalbe, Cengage Learning publication. Information Technology Project Management by Jack T Marchewka Wiley India publication.
3. **Software Engineering** 3rd edition by KK Agrawal, Yogesh Singh, New Age International publication. Software Engineering Project Management by Richard H. Thayer Wiley India Publication.
4. **Software Engineering**, A Precise Approach: Pankaj Jalote, Wiley India-2010 2.
5. **Software Project Management**: Saikat Dutt /S. Chandramouli, Pearson-Second Edition
6. Ken Schwaber, "**Agile Project Management**", Microsoft Press, 2004
7. Walker Royce, "**Software Project Management**", Addison-Wesley, 1998

Practicals:

Laboratory Assignments:

1. Formulation of a problem statement.
2. Documentation for the Software Requirement Specification Document, Design Documents, and Documentation for the Testing Phase.
3. Documentation relating to Software Configuration Management and Risk Management.
4. Research and application of any CASE tool for the design phase
5. Using any Design phase CASE tools to complete the design.
6. Create unit testing and integration testing test cases.
7. Create test cases for a variety of white-box and black-box testing methods.

Mini Project documentation and/or implementation- Consider any one system given below in order to implement a mini project documentation.

Set of Systems for above lab assignments:

1. Online hotel booking systems
2. Stock Market Risk Analysis
3. Hospital Management System
4. Shopping Mall Inventory Management
5. Student Attendance Management System

1. Create Project Plan

- ✓ Specify project name and start (or finish) date.
- ✓ Identify and define project tasks.
- ✓ Define duration for each project task.
- ✓ Define milestones in the plan
- ✓ Define dependency between tasks
- ✓ Define project calendar.
- ✓ Define project resources and specify resource type
- ✓ Assign resources against each task and baseline the project plan

2. Execute and Monitor Project Plan

- ✓ Update % Complete with current task status.
- ✓ Review the status of each task.
- ✓ Compare Planned vs Actual Status
- ✓ Review the status of Critical Path
- ✓ Review resources assignation status

3. Generate Dashboard and Reports

- ✓ Dashboard Project Overview
- ✓ Cost Overview
- ✓ Upcoming Tasks
- ✓ Resource Reports
- ✓ Over-allocated Resources
- ✓ Resource Overview
- ✓ Cost Reports
- ✓ Earned Value Report
- ✓ Resource Cost Overview
- ✓ Task Cost Overview
- ✓ Progress Reports
- ✓ Critical Tasks

- ✓ Milestone Report
- ✓ Slipping Tasks

@The CO-PO Mapping Matrix

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CO 4	1	2	-	2	-	-	-	-	-	-	-	-
CO 5	-	-	2	-	-	-	-	-	-	-	-	-
CO 6	-	2	1	2	-	-	-	-	-	-	-	-
Co7	1	2	2	-	-	-	-	-	-	-	-	-

TITLE OF THE COURSE: Discrete Structure

Dr D. Y. Patil School of Science &Technology,
Dr D. Y. Patil Vidyapeeth, Pimpri, Pune

PCC-AI 303: Database Management Systems

Teaching Scheme	Credit Scheme	Examination Scheme and Marks
Lecture: 03 Hours/Week	05	Internal Assessment (TH): 40 Marks
Practical: 04 Hours/Week		End Semester (TH): 60 Marks

Course Objective:

1. To understand the fundamental concepts and the applications of Database Management Systems.
2. To acquire the skillset to use flexible databases for real applications.
3. To get familiar with Data Collection and Design techniques.
4. To design a Database Management Systems for scalable projects.
5. To relate different DB languages like MySQL, Noe4J, Riak, MongoDB.
6. To understand the relational database design principles.

Course Outcomes:

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

CO1: To analyze and design the basic elements of a relational database management system.
CO2: To learn to normalise the databases using single value normalization.
CO3: To identify the relevant data models for problems.
CO4: To design and evaluate entity relationship and convert entity relationship diagrams into RDBMS and formulate SQL queries on the respect data into RDBMS and formulate SQL queries on the data.
CO5: To interpret the query evaluation and optimization techniques.
CO6: To understand NoSQL Database.

Prerequisites:

Basic knowledge of Data Structures and Algorithms, Discrete Mathematics is required.

Unit I	**Introduction to Database**	**(06 Hours)**
Database Concepts, Database System Architecture and Data Modeling: Data Models, Basic Concepts, entity, attributes, relationships, constraints, keys. E-R and EER diagrams: Components of E-R Model, conventions, converting E-R diagram into tables, EER Model components, converting EER diagram into tables, legacy system model. Relational Model: Basic concepts, Attributes and Domains, Codd's Rules. Relational Integrity: Domain, Entity, Referential Integrities, Enterprise Constraints, Schema Diagram. Relational Algebra: Basic Operations, Selection, projection, joining, outer join, union, difference, intersection, Cartesian product, division operations (examples of queries in relational algebraic using symbols).		
Mapping of Course Outcomes	CO1	
Unit II	**Data Collection**	**(06 Hours)**

Data Processing - Data collection; Data preparation; Training a model on the data; Evaluation of the model performance ; Data visualization techniques and inferences - scatter plot, scatter matrix, histogram, box plot.

Mapping of Course Outcomes	CO2

Unit III	**Database Design &SQL**	**(08 Hours)**

Functional Dependency, Purpose of Normalization, Data Redundancy and Update Anomalies, Single Valued Normalization: 1NF, 2NF, 3NF, BCNF. Decomposition: lossless join decomposition and dependency preservation, Multi valued Normalization (4NF), Join Dependencies and the Fifth Normal Form. Introduction to SQL: Characteristics and advantages, SQL Data Types and Literals, DDL, DML, DCL, SQL Operators, Tables: Creating, Modifying, Deleting, Views: Creating, Dropping, Updating using Views, Indexes, Nulls SQL DML Queries: SELECT Query and clauses, Set Operations, Predicates and Joins, Set membership, Tuple Variables, Set comparison, Ordering of Tuples, Aggregate Functions, Nested Queries, Database Modification using SQL Insert, Update and Delete Queries

Mapping of Course Outcomes	CO3

Unit IV	**Query Processing and Database transactions**	**(06 Hours)**

Query Processing: Overview, Measures of query cost, Evaluation of expression, Materialization and Pipelining algorithm. Transaction: Basic concept of a Transaction, Transaction Management, Properties of Transactions, Concept of Schedule, Serial Schedule, Serializability: Conflict and View, Cascaded Aborts, Recoverable and No recoverable Schedules. Concept of Stored Procedures, Cursors, Triggers, assertions, roles and privileges Programmatic SQL: Embedded SQL, Dynamic SQL, Advanced SQL-Programming in MYSQL.

Mapping of Course Outcomes	CO4

Unit V	**Concurrency Control**	**(07 Hours)**

Concurrency Control: Need, Locking Methods, Deadlocks, Time-stamping Methods, and Optimistic Techniques. Recovery Methods: Shadow-Paging and Log-Based Recovery, Checkpoints, Performance Tuning, Query Optimization

Mapping of Course Outcomes	CO5

Unit VI	**NoSQL databases**	**(07 Hours)**

Introduction, Overview, and History of NoSQL Databases – The Definition of the Four Types of NoSQL Databases, Column-oriented NoSQL databases using Apache HBASE, Column-oriented NoSQL databases using Apache Cassandra NoSQL Key/Value databases using MongoDB, NoSQL Key/Value databases using Riak, Graph NoSQL databases using Neo4J, NoSQL database development tools and programming languages Future Trends for NoSQL databases

Mapping of Course Outcomes	CO6

Text Books:

1. Raghurama Krishnan, Johannes Gehrke , Database Management Systems, 3rd edition, Tata McGraw Hill, New Delhi,India
2. Elmasri Navate, Fundamentals of Database Systems, Pearson Education,India.

Reference Books:

1. Abraham Silberschatz, Henry F. Korth, S. Sudarshan (2005), Database System Concepts, 5th edition, McGraw-Hill, New Delhi,India.
2. Peter Rob, Carlos Coronel (2009), Database Systems Design, Implementation and Management, 7thedition

Methodology:

The course will be covered through lectures, audio- visual tools, DB tools and supported by practical.

Practical's:

Assignments from all Groups (A, B, C) are compulsory.

Group- A:

1. Draw E-R diagram and convert entities and relationships to relation table for a given scenario. a. Two assignments shall be carried out i.e. consider two different scenarios (eg. bank, college)
2. Install and configure client and server for MySQL and MongoDB (Show all commands and necessary steps for installation and configuration).
3. Perform the following: a. Viewing all databases, creating a Database, Viewing all Tables in a Database, Creating Tables (With and Without Constraints), Inserting/Updating/Deleting Records in a Table, Saving (Commit) and Undoing (rollback)
4. Perform the following: a. Altering a Table, Dropping/Truncating/Renaming Tables, backing up / Restoring a Database.
5. For a given set of relation schemes, create tables and perform the following Simple Queries, Simple Queries with Aggregate functions, Queries with Aggregate functions (group by and having clause), Queries involving- Date Functions, String Functions, Math Functions Join Queries- Inner Join, Outer Join Subqueries- with IN clause, With EXISTS clause.
6. For a given set of relation tables perform the following a. Creating Views (with and without check option), Dropping views, Selecting from a view.
7. Write a Pl/SQL program using FOR loop to insert ten rows into a database table.
8. Given the table EMPLOYEE (EmpNo, Name, Salary, Designation, DeptID) write a cursor to select the five highest paid employees from the table.
9. Illustrate how you can embed PL/SQL in a high-level host language such as C/Java and demonstrates how a banking debit transaction might be done.
10. Given an integer i, write a PL/SQL procedure to insert the tuple (i, 'xxx') into a given relation.
11. Study the Riak database and its uses. Also elaborate on building and installing of Riak.

Group B-

MongoDB/Apache Cassandra Queries:

1. Design and Develop MongoDB/Apache Cassandra Queries using CRUD operations. (Use CRUD operations, SAVE method, logical operators etc.).
2. MongoDB/Apache Cassandra - Aggregation and Indexing: Design and Develop MongoDB Queries using aggregation and indexing with suitable example using MongoDB.
3. MongoDB/Apache Cassandra - Map reduces operations: Implement Map reduces operation with suitable example using MongoDB.
4. Database Connectivity: Write a program to implement MongoDB database connectivity

Note* - Teachers can take the flexibility to use any other advanced tools Instead of MongoDB/Apache Cassandra

Group C-

Using the database concepts covered in Group A and Group B, develop an application with following details: 1. Follow the same problem statement decided in Assignment -1 of Group A.

2. Follow the Software Development Life cycle and other concepts learnt in Software Engineering Course throughout the implementation.

3. Develop application considering:

- Front End : Java/Perl/PHP/Python/Ruby/.net/any other language
- Backend : MongoDB/MySQL/Oracle

4. Test and validate application using Manual/Automation testing.

5. Student should develop application in group of 2-3 students and submit the Project Report which will consist of documentation related to different phases of Software Development Life Cycle:

- Title of the Project, Abstract, Introduction
- Software Requirement Specification
- Conceptual Design using ER features, Relational Model in appropriate Normalize form
- Graphical User Interface, Source Code
- Testing document
- Conclusion.
    -

@The CO-PO Mapping Matrix

CO\ PO	PO1	PO2	PO3	PO4	PO 5	PO6	PO7	PO 8	PO9	PO1 0	PO1 1	PO 12
CO	1	1	2	1	-	-	-	-	-	-	-	-
CO 2	1	2	-	2	-	-	-	-	-	-	-	-
CO 3	2	1	2	1	-	-	-	-	-	-	-	-
CO 4	1	2	-	2	-	-	-	-	-	-	-	-
CO 5	-	-	2	-	-	-	-	-	-	-	-	-
CO 6	-	2	1	2	-	-	-	-	-	-	-	-
Co7	1	2	2	-	-	-	-	-	-	-	-	-

Dr D. Y. Patil School of Science &Technology,
Dr D. Y. Patil Vidyapeeth, Pimpri, Pune

PCC-AI 304: Project Based Learning-II

Teaching Scheme	Credit Scheme	Examination Scheme and Marks
Lecture: 0 Hours/Week	03	Internal Assessment (TH): 40 Marks
		End Semester (TH): 60 Marks

Course Objective:

1. To emphasizes learning activities that are long-term, inter-disciplinary and student centric.
2. To engages students in rich and authentic learning experiences.
3. To provide every student the opportunity to get involved either individually or as a group so as to develop team skills and learn professionalism.
4. To develop an ecosystem this may promote entrepreneurship and research culture among the students.

Course Outcomes:

CO1: To solve real life problems by applying knowledge.
CO2: To analyze alternative approaches, apply and use most appropriate one for feasible solution.
CO3: To understand basics of IT Project management
CO4: To accept and meet challenges in the real world, mirroring what professionals do every day.
CO5: To classify software applications and identify unique features of various domains
CO6: To promote long-term retention of material and replicable skill, as well as improve teachers' and students' attitudes towards learning through learning by doing approach in PBL.

Prerequisites

Basic knowledge of problem-based learning is required

Course Contents Preamble:

Along with traditional classroom teaching and laboratory work-based learning, project-based learning has been introduced with the goal of motivating students to study by working in groups (3 to 4 students per group) courteously to achieve a better learning experience.
Students may work on a problem that is theoretical, practical, or both in order to find the solution to an any real world problem. It might be social, technological, symbolic, cultural, or scientific, and it stems from students' curiosity.
Project-based learning is an instructional approach designed to give students the opportunity to develop knowledge and skills through engaging projects set around challenges and problems they may face in the real world. PBL, is more than just projects. With PBL students "investigate and respond to an authentic, engaging, and complex problem, or challenge" with deep and sustained attention. PBL is "learning by doing." The truth is, many in education are recognizing we live in a modern world sustained and advanced through the successful completion of projects. In short, If students are prepared for success in life, we need to prepare them for a project-based world. It is a style of active learning and inquiry-based learning. (Reference: Wikipedia). Project based learning will also redefine the role of teacher as mentor in learning

process. Along with communicating knowledge to students, often in a lecture setting, the teacher will also to act as an initiator and facilitator in the collaborative process of knowledge transfer and development. The PBL model focuses the student on a big open-ended question, challenge, or problem to research and respond to and/or solve. It Brings what students should academically know, understand, and be able to do and requires students to present their problems, research process, methods, and results.

Assessment Scheme:

Group may demonstrate their knowledge and skills by developing a public product and/or report and/or presentation.

1. Individual assessment for each student (Understanding individual capacity, role and involvement in the project)
2. Group assessment (roles defined, distribution of work, intra-team communication and togetherness)
3. Documentation and presentation Evaluation and Continuous Assessment
4. It is recommended that all activities should to be recorded regularly, regular assessment of work need to be done and proper documents need to be maintained at college end by both students as well as mentor (PBL work book). Continuous Assessment Sheet (CAS) is to be maintained by all mentors/department and institutes.

Recommended parameters for assessment/evaluation and weightage:

1. Idea Inception and Awareness /Consideration of -Environment/ Social /Ethics/ Safety measures/Legal aspects (10%)
2. Outcomes of PBL/ Problem Solving Skills/ Solution provided/ Final product (Individual assessment and team assessment) (40%)
3. Documentation (Gathering requirements, design &modelling, implementation/ execution, use of technology and final report, other documents) (15%)
4. Demonstration (Presentation, User Interface, Usability) (20%)
5. Contest Participation/ publication (15%) PBL workbook will serve the purpose and facilitate the job of students, mentor and project coordinator. It will reflect accountability, punctuality, technical writing ability and work flow of the work undertaken.

Note:

- While planning for the assessment, choose a valid method based on your context. It should be able to understand by both the students as well as the faculty.
- The student group must follow the principles of Software Engineering (Scoping out the problem, the solution implementation and related documentation).
- Researching the problem and outlining various approaches is key here and should be emphasized by the tutor and the mentor.
- Aspects of design thinking (from the point of view of the person facing the problem) are very important. Students should not jump into the technology aspects first.
- The team can follow the principles of Agile Software Development. The weekly meetings could be used as a Scrum meeting.
- The tutor & mentor should actively help the students to scope the work and the approach. They must validate the technology choices

@The CO-PO Mapping Matrix

CO\ PO	PO1	PO2	PO3	PO4	PO 5	PO6	PO7	PO 8	PO9	PO1 0	PO1 1	PO 12
CO	1	1	2	1	-	-	-	-	-	-	-	-
CO 2	1	2	-	2	-	-	-	-	-	-	-	-
CO 3	2	1	2	1	-	-	-	-	-	-	-	-
CO 4	1	2	-	2	-	-	-	-	-	-	-	-
CO 5	-	-	2	-	-	-	-	-	-	-	-	-
CO 6	-	2	1	2	-	-	-	-	-	-	-	-
Co7	1	2	2	-	-	-	-	-	-	-	-	-

Dr. D. Y. Patil School of Science &Technology,
Dr. D. Y. Patil Vidyapeeth, Pimpri, Pune

HSMC 201: Universal Human Values -II

Teaching Scheme	Credit Scheme	Examination Scheme and Marks
Lecture: 02 Hours/Week	03	Internal Assessment: 40 Marks
		End Semester: 60 Marks

HUMAN VALUES COURSES:

During the Induction Program, students would get an initial exposure to human values through Universal Human Values – I. This exposure is to be augmented by this compulsory full semester foundation course.

Course Objective

The objective of the course is four-fold:

1. To development of a holistic perspective based on self- exploration about themselves (human being), family, society and nature/existence.
2. To understanding (or developing clarity) of the harmony in the human being, family, society and nature/existence
3. To strengthening of self-reflection.
4. To development of commitment and courage to act.

PRE-REQUISITES: None. Universal Human Values 1 (Desirable)

COURSE TOPICS: The course has 28 lectures and 14 practice sessions in 5modules:

The objective of this course is to familiarize the prospective engineers withtechniques in calculus, multivariate analysis and linear algebra. It aims to equipthe students with standard concepts and tools at an intermediate to advancedlevel that will serve them well towards tackling more advanced level ofmathematics and applications that they would find useful in their disciplines. The students will learn:

Module 1: Course Introduction - Need, Basic Guidelines, Content and Process for Value Education

1. Purpose and motivation for the course, recapitulation from Universal Human Values-I.
2. Self-Exploration–what is it? - Its content and process; „Natural Acceptance‟ and Experiential Validation- as the process for self-exploration.
3. Continuous Happiness and Prosperity- A look at basic Human Aspirations
4. Right understanding, Relationship and Physical Facility- the basic requirements for fulfilment of aspirations of every human being with their correct priority.
5. Understanding Happiness and Prosperity correctly- A critical appraisal of the current scenario 6. Method to fulfil the above human aspirations: understanding and living in harmony at various levels. Include practice sessions to discuss natural acceptance in human being as the innate acceptance for living with responsibility (living in relationship, harmony and co-existence) rather than as arbitrariness in choice based on liking-disliking.

Module 2: Understanding Harmony in the Human Being - Harmony in Myself!

1. Understanding human being as a co-existence of the sentient „I‟ and the material „Body‟.
2. Understanding the needs of Self („I‟) and „Body‟ - happiness and physical facility.
3. Understanding the Body as an instrument of „I‟ (I being the doer, seer and enjoyer).
4. Understanding the characteristics and activities of „I‟ and harmony in „I‟.
5. Understanding the harmony of I with the Body: Sanyam and Health; correct appraisal of Physical needs, meaning of Prosperity in detail.
6. Programs to ensure Sanyam and Health.

Include practice sessions to discuss the role others have played in making material goods available to me. Identifying from one‟s own life. Differentiate between prosperity and accumulation. Discuss program for ensuring health vs dealing with disease.

Module 3: Understanding Harmony in the Family and Society- Harmony in Human-Human Relationship

1. Understanding values in human-human relationship; meaning of Justice (nine universal values in relationships) and program for its fulfilment to ensure mutual happiness; Trust and Respect as the foundational values of relationship
2. Understanding the meaning of Trust; Difference between intention and competence
3. Understanding the meaning of Respect, Difference between respect and differentiation; the other salient values in relationship
4. Understanding the harmony in the society (society being an extension of family): Resolution, Prosperity, fearlessness (trust) and co-existence as comprehensive Human Goals
5. Visualizing a universal harmonious order in society- Undivided Society, Universal Order- from family to world family. Include practice sessions to reflect on relationships in family, hostel and institute as extended family, real life examples, teacher-student relationship, goal of education etc. Gratitude as a universal value in relationships. Discuss with scenarios. Elicit examples from students‟ lives.

Module 4: Understanding Harmony in the Nature and Existence - Whole existence as Coexistence

1. Understanding the harmony in the Nature
2. Interconnectedness and mutual fulfilment among the four orders of nature- recyclability and self-regulation in nature.
3. Understanding Existence as Co-existence of mutually interacting units in all-pervasive space.
4. Holistic perception of harmony at all levels of existence.
5. Include practice sessions to discuss human being as cause of imbalance in nature (film “Home” can be used), pollution, depletion of resources and role of technology etc.

Module 5: Implications of the above Holistic Understanding of Harmony on Professional Ethics

1. Natural acceptance of human values
2. Definitiveness of Ethical Human Conduct
3. Basis for Humanistic Education, Humanistic Constitution and Humanistic Universal Order.
4. Competence in professional ethics: a. Ability to utilize the professional competence for augmenting universal human order b. Ability to identify the scope and characteristics of people friendly and eco-friendly production systems, c. Ability to identify and develop appropriate technologies and management patterns for above production systems.
5. Case studies of typical holistic technologies, management models and production systems
6. Strategy for transition from the present state to Universal Human Order: a) At the level of individual: as socially and ecologically responsible engineers, technologists and managers b) At the level of society: as mutually enriching institutions and organizations
7. Sum up. Include practice Exercises and Case Studies will be taken up in Practice (tutorial) Sessions e.g. to discuss the conduct as an engineer or scientist etc.

Text Book:

1.Human Values and Professional Ethics by R R Gaur, R Sangal, G P Bagaria, Excel Books, New Delhi, 2010

Reference Book:

1. Jeevan Vidya: EkParichaya, A Nagaraj, Jeevan Vidya Prakashan, Amarkantak, 1999.
2. Human Values, A.N. Tripathi, New Age Intl. Publishers, New Delhi, 2004.
3. The Story of Stuff (Book).
4. The Story of My Experiments with Truth - by Mohandas Karamchand Gandhi.
5. Small is Beautiful - E. F Schumacher.
6. Slow is Beautiful - Cecile Andrews
7. Economy of Permanence - J C Kumarappa
8. Bharat Mein Angreji Raj – PanditSunderlal

9. Rediscovering India - by Dharampal
10. Hind Swaraj or Indian Home Rule - by Mohandas K. Gandhi
11. India Wins Freedom - Maulana Abdul Kalam Azad
12. Vivekananda - Romain Rolland (English)
13. Gandhi - Romain Rolland (English)

MODE OF CONDUCT (L-T-P-C 2-1-0-3 or 2L: 1T:0P 3 credits):

Lectures hours are to be used for interactive discussion, placing the proposals about the topics at hand and motivating students to reflect, explore and verify them. Tutorial hours are to be used for practice sessions While analyzing and discussing the topic, the faculty mentor's role is in pointing to essential elements to help in sorting them out from the surface elements. In other words, help the students explore the important or critical elements.

In the discussions, particularly during practice sessions (tutorials), the mentor encourages the student to connect with one's own self and do self- observation, self-reflection and self-exploration.

Scenarios may be used to initiate discussion. The student is encouraged to take up "ordinary" situations rather than" extra-ordinary" situations. Such observations and their analyses are shared and discussed with other students and faculty mentor, in a group sitting.

Tutorials (experiments or practical) are important for the course. The difference is that the laboratory is everyday life, and practical are how you behave and work in real life. Depending on the nature of topics, worksheets, home assignment and/or activity are included. The practice sessions (tutorials) would also provide support to a student in performing actions commensurate to his/her beliefs. It is intended that this would lead to development of commitment, namely behaving and working based on basic human values. It is recommended that this content be placed before the student as it is, in the form of a basic foundation course, without including anything else or excluding any part of this content. Additional content may be offered in separate, higher courses.

This course is to be taught by faculty from every teaching department, including HSS faculty. Teacher preparation with a minimum exposure to at least one 8- day FDP on Universal Human Values is deemed essential.

ASSESSMENT:

This is a compulsory credit course. The assessment is to provide a fair state of development of the student, so participation in classroom discussions, self-assessment, peer assessment etc. will be used in evaluation.

@The CO-PO Mapping Matrix

CO\ PO	PO1	PO2	PO3	PO4	PO 5	PO6	PO7	PO 8	PO9	PO1 0	PO1 1	PO 12
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CO 2	1	2	-	2	-	-	-	-	-	-	-	-
CO 3	2	1	2	1	-	-	-	-	-	-	-	-
CO 4	1	2	-	2	-	-	-	-	-	-	-	-
CO 5	-	-	2	-	-	-	-	-	-	-	-	-
CO	-	2	1	2	-	-	-	-	-	-	-	-

6												
Co7	1	2	2				-	-	-	-	-	-

SEMESTER - IV

SEMESTER IV						
Course Code	**Course Name**	**L**	**T**	**P**	**Hr**	**Cr**
PCC-AI 401	**Artificial Intelligence**	3	0	4	7	5
PCC-AI 402	**Digital Logic Design and Processor Architecture**	3	0	4	7	5
PCC-AI 403	**Computer Networks**	3	0	4	7	5
PCC-AI 404	**R Programming**	2	0	4	6	4
PCC-AI 405	**Foundations of Data Science**	3	0	4	7	5
Total		**14**	**0**	**20**	**34**	**24**

Dr. D. Y. Patil School of Science &Technology,
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PCC-AI 401: Artificial Intelligence

Teaching Scheme	Credit Scheme	Examination Scheme and Marks
Lecture: 03 Hours/Week	05	Internal Assessment (TH): 40 Marks
Practical: 04 Hours/Week		End Semester (TH): 60 Marks

Course Objective:

The objective of this course is:

1. To understand the concepts of Artificial Intelligence (AI).
2. To understand strength of and weakness of searching algorithms.
3. To learn and compare the searching techniques for AI applications.
4. To acquaint with the various knowledge representation & experts' systems.
5. To understand basic probability notations in artificial Intelligence/ Game theory.
6. To acquaint with the fundamentals of knowledge presentations and reasoning.

Course Outcomes:

On completion of the course, learner will be able to–

CO1: To understand the fundamentals of Artificial Intelligence
CO2: To design smart system using different search strategies of Artificial Intelligence
CO3: To analyze various basic probability notations, game theory
CO4: To apply various algorithms for Artificial Intelligence application development
CO5: To implement Artificial Intelligence solutions using logical reasoning
CO6: To analyze the knowledge presentation and expert systems

Prerequisites:

Students needs to have basic knowledge of linear algebra, vector, matrix, probability, Propositional Logic & python programming.

Unit I	**Introduction**	**(06 Hours)**
Introduction: History & overview of Artificial Intelligence, Different Definitions, Problem Solving Strategies, Applications, Physical Symbol System Hypothesis, production systems, Characteristics of production, Agents and Environments – Concept of rationality – Nature of environments – Structure of agents.		
Mapping of Course Outcomes	CO1	
Unit II	**Searching Techniques**	**(07 Hours)**
Uninformed Search, depth first search , breadth first search, Heuristic Search Strategies (Greedy Best First Search, A* Search, Memory Bounded Heuristic Search) Evolutionary algorithms Local Search Algorithms (Hill-Climbing Search, Simulated Annealing Search, Local Beam Search)		
Mapping of Course Outcomes	CO2	
Unit III	**Basic Probability Notation**	**(08 Hours)**

Home

Inference Using Full Joint Distribution, Independence, Bayes' Rule and it's Use The Planning Problem, Planning with State Space Search, Planning Graphs, Efficient Representation of Conditional Distribution, Exact Inference, Approximate Inference Extending Probability to First Order Representations Alternatives for Uncertain Reasoning.		
Mapping of Course Outcomes	CO3	
Unit IV	**Game Playing**	**(08 Hours)**
Constraint Satisfaction Problems(CSP), constraint propagation, backtracking search for CSP, local search for CSP, structure of CSP , Minimax & Alpha-Beta Pruning Algorithm, Imperfect Real-time decisions, Knowledge Based Agents, Example, Propositional Logic, Reasoning Patterns in Propositional Logic, Syntax and semantics of First Order Logic, Inference in First Order Logic Knowledge Base Reasoning Systems for Categories (Semantic Networks, Description Logics), Reasoning with default Information Acting under uncertainty		
Mapping of Course Outcomes	CO4	
Unit V	**Formalized & Propositional Logic**	**(06 Hours)**
Formalized symbolic logic: Propositional logic-first order predicate logic, wff conversion to clausal form, inference rules, the resolution principle, Dealing with inconsistencies and uncertainties, fuzzy logic. Probabilistic Reasoning Structured knowledge, graphs, frames and related structures, Knowledge organization and manipulation. Matching Techniques, Knowledge organizations, Management.		
Mapping of Course Outcomes	CO5	
Unit VI	**Knowledge Representation and Expert Systems**	**(08 Hours)**
Knowledge representation, Natural Language processing, Pattern recognition, expert systems, introduction to machine learning Case Study: Sentiment Analysis, Case Study: Object Recognition. Ontological engineering		
Mapping of Course Outcomes	CO6	

Methodology

The course will be covered through lectures, NPTEL course cntents, PPTs and supported by practical.

Reference Books:

1. Artificial Intelligence: Elaine Rich, Kevin Knight, Mc-GrawHill.
2. Introduction to AI & Expert System: Dan W.Patterson, PHI.
3. Artificial Intelligence by Luger (Pearson Education)
4. Artificial Intelligence, A Modern Approach. Stuart Russell and Peter Norvig.
5. Thomas Haslwanter, "An Introduction to Statistics with Python with Applications in the Life 6. Sciences", Springer International Publishing Switzerland 2016, ISBN 978-3-319- 28315-9, ISBN 978-3-319-28316-6 (eBook)
7. Peter Bruce and Andrew Bruce, "Practical Statistics for Data Scientists", First Edition, O'Reilly Media, ISBN-978-1-491-95296-2
8. Allen B. Downey, "Think Stats", Second Edition, O'Reilly Media, ISBN: 978-1-491- 90733-7

Practical :

1. Study & list tuple, set, dictionary, classes, inheritance in Python
2. Study and understand simple reflex and Model Based Agent
3. Implement graph in Python for profit or loss in banking application
4. Describe the given problem statement using PEAS description.
5. Implement basic searching algorithm for given AI problem
6. Write a program to solve 8 Queens' problem
7. Implement memory bounded A* & A* algorithm for given problem.
8. Implement Alpha Beta Tree search.
9. Implement classical planning algorithm
10. Solve Robot Obstacle/transversal problem means end analysis.

CO\ PO	PO1	PO2	PO3	PO4	PO 5	PO6	PO7	PO 8	PO9	PO1 0	PO1 1	PO 12
CO	1	1	2	1	-	-	-	-	-	-	-	-
CO 2	1	2	-	2	-	-	-	-	-	-	-	-
CO 3	2	1	2	1	-	-	-	-	-	-	-	-
CO 4	1	2	-	2	-	-	-	-	-	-	-	-
CO 5	-	-	2	-	-	-	-	-	-	-	-	-
CO 6	-	2	1	2	-	-	-	-	-	-	-	-

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PCC-AI 402: Digital Logic Design and Processor Architecture

Teaching Scheme	Credit Scheme	Examination Scheme and Marks
Lecture: 02 Hours/Week	05	Internal Assessment (TH): 40 Marks
Practical: 04 Hours/Week		End Semester (TH): 60 Marks

Course Objective:

1. To present a problem oriented introductory knowledge of Digital circuits and its applications.
2. To study number systems and develop skills for design and implementation of combinational logic circuits and sequential circuits
3. To understand the functionalities, properties, and applicability of Logic Families.
4. To introduce programmable logic devices and ASM chart and synchronous state machines.
5. To learn the basics of microprocessor.
6. To study number systems and develop skills for design and implementation of combinational logic circuits and sequential circuits

Course Outcomes:

CO1: To learn the basics of combinational as well as sequential logic.

CO2: To simplify Boolean Expressions using K Map.

CO3: To design and implement combinational circuits.

CO4: To design and implement sequential circuits.

CO5: To develop simple real-world application using ASM and PLD.

CO6: To choose appropriate logic families IC packages as per the given design specifications
CO7: To explain organization and architecture of computer system
CO8: To comprehend the treatment of sequential circuits and state machines.
CO9: To learn how to analyze the performance of digital circuit.

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Prerequisites:

Basic knowledge of digital electronics is required

Unit I	**Fundamentals of Digital Techniques & Minimization Technique**	**(06 Hours)**
Number System, Boolean Logic, Truth Tables, Logic Gates, Universal Gates, Laws of Boolean algebra, De-Morgan's theorem, Min term, Max term, POS, SOP, K-Map, Simplification by Boolean theorems, don't care condition. Sign Magnitude Representation, Quine Mc-Clunky Method		
Mapping of Course Outcomes	CO1,CO2	
Unit II	**Combinational circuit**	**(06 Hours)**
The Half adder, the full adder, Subtractor circuit. Multiplexer de-multiplexer, decoder, BCD to seven segment Decoder, encoders, set-reset laches, D-Flip-Flop, R-S Flip-Flop, J-K Flip-flop, Master slave Flip flop, edge triggered flip-flop, T flip-flop, Code Converter such as BCD to Ex-3 and Binary to grey code converter Combinational IC ,such as 74153,74151, 7486 .		
Mapping of Course Outcomes	CO3	
Unit III	**Sequential Circuits Design**	**(08 Hours)**
Synchronous/Asynchronous counter Operation, Up/down synchronous counter, application of counter, Serial in/Serial out shift register Serial in/Serial out shift register. Serial in/Serial out shift register, Serial in/parallel out shift register, parallel in/ parallel out shift register, parallel in/Serial out shift register, Bi-directional register, Moore and Mealy, State diagram and State Table ,Design Procedure.		

Home

Mapping of Course Outcomes	CO4,CO5	
Unit IV	**Introduction to Computer Architecture**	**(06 Hours)**
Computer architecture, functional Units – Basic Operational Concepts – Performance – Instructions: Language of the Computer – Operations, Operands – Instruction representation – Logical operations – decision making – MIPS Addressing.		
Mapping of Course Outcomes	CO6	
Unit V	**Processor Architecture**	**(08 Hours)**
Microprocessor architecture(8086 or 80386) A Basic MIPS implementation – Building a Data path – Control Implementation Scheme – Pipelining – Pipelined data path and control – Handling Data Hazards & Control Hazards – Exceptions.		
Mapping of Course Outcomes	C07	
Unit VI	**Parallel Processing**	**(06 Hours)**
Flynn‘s classification – SISD, MIMD, SIMD, SPMD, and Vector Architectures – Hardware multithreading – Multi-core processors and other Shared Memory Multiprocessors – Introduction to Graphics Processing Units, Clusters, Warehouse Scale Computers and other Message-Passing Multiprocessors.		
Mapping of Course Outcomes	CO8	

Methodology

The course will be covered through lectures videos and PPT.

Reference Books:

1. Digital Fundamentals by Morris and Mano, PHI Publication
2. Fundamental of digital circuits by A.ANANDKUMAR, PHI Publication
3. Digital Fundamentals by FLOYD & JAIN, Pearsons Publication
4. Fundamentals of Logic Design by Charles H. Roth Thomson

Practical:

1. To Realize Full Adder/ Subtractor using a) Basic Gates and b) Universal Gates
2. Design and implement Code Converters-Binary to Gray and BCD to Excess-3
3. Flip Flop Conversion: Design and Realization
4. Design of 2 bit and 3 bit Ripple Counter using MS JK flip-flop.
5. Study of Shift Registers (SISO,SIPO, PISO,PIPO)
6. Realization of Boolean Expression for suitable combination logic using MUX 74151 / DMUX 74154
7. To Verify the truth table of two bit comparators using logic gates
8. Design & Implement Parity Generator

@The CO-PO Mapping Matrix

CO\ PO	PO1	PO2	PO3	PO4	PO 5	PO6	PO7	PO 8	PO9	PO1 0	PO1 1	PO 12
CO	1	1	2	1	-	-	-	-	-	-	-	-
CO 2	1	2	-	2	-	-	-	-	-	-	-	-
CO 3	2	1	2	1	-	-	-	-	-	-	-	-
CO 4	1	2	-	2	-	-	-	-	-	-	-	-
CO 5	-	-	2	-	-	-	-	-	-	-	-	-
CO 6	-	2	1	2	-	-	-	-	-	-	-	-
Co7	1	2	2	-	-	-	-	-	-	-	-	-

Dr. D. Y. Patil School of Science &Technology,
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PCC-AI 403: Computer Networks

Teaching Scheme	Credit Scheme	Examination Scheme and Marks
Lecture: 03 Hours/Week	05	Internal Assessment: 40 Marks
Practical: 04 Hours/Week		End Semester (TH): 60 Marks

Course Objective:

The objective of this course is:

1. To get a basic understanding of networking standards, protocols, and technology.
2. To learn various framing, error control, flow management, and routing techniques.
3. To understand the role of protocols at different layers of the protocol stack. To get knowledge in network programming.
4. To analyze the contents in the layers using simulation tools.
5. To design and implement routing algorithms.
6. Using Modern Tools, demonstrate LAN and WAN protocol behavior.
7. Using Application, Transport, and Network Layer Protocols, examine data flow between peers in an IP network.
8. Demonstrate basic switch and router configuration.

Course Outcomes:

On completion of the course, student will be able to–

CO1: To analyse the needs of a certain organisational structure to determine the best networking architecture, topologies, transmission channels, and technologies.

CO2: To demonstrate concerns with design, flow, and error control.

CO3: Analyse data flow utilising the Application, Transport, and Network Layer Protocols in the TCP/IP paradigm.

CO4: To demonstrate how computer network capabilities, selection, and usage can be applied to various sectors of the user community. Using appropriate standards and technology, illustrate Client-Server architectures and prototypes.

CO5: To showcase various routing and switching strategies

Prerequisites

Student should have a fundamental understanding of programming and digital electronics, computer organizations.

Unit I	**Introduction**	**(6 Hours)**
Basics of Networks: - Definition, Need, Applications, Network Topologies, BUS, STAR, MESH, Hybrid: Definition, Advantages & Disadvantages, Applications OSI Reference Model: Diagram, Working & Significance of Each Layer. Protocol Basics: Definition, Types of Protocols, Usage of Various Protocols, Networking Components (Hardware): Cables & Connectors (Coaxial, UTP/STP, Fiber Optics, Cat(x)Cables), Switches (Unmanaged, Smart Web Managed, Full Managed), Hardware/Software Firewall, Study of UTM, Wireless Routers DSL/ADSL – Latest Examples and Usage.		
Mapping of Course Outcomes	CO1	
Unit II	**Physical Layer**	**(07 Hours)**

Introduction to LAN, MAN, WAN, PAN, Ad-hoc Network, Network Architectures: Client-Server, Peer-to-Peer, Distributed, and SDN, OSI Model, TCP/IP Model, OSI Model, TCP/IP Model, Star and hierarchical topologies; Layers, Transmission Mediums: CAT5, 5e, 6, OFC, and Radio Spectrum, Network Devices: Bridge, Switch, Router, and Access Point, Manchester and Differential Manchester Encodings; IEEE802.11: Frequency Hopping (FHSS) and Direct Sequence; Direct sequences		
Mapping of Course Outcomes	CO2	
Unit III	**Data Link Layer**	**(08 Hours)**
Services to the Network Layer, Framing, Error Control, and Flow Control are all design issues. Parity Bits, Hamming Codes (11/12-bits), and Unrestricted Simplex, Stop and Wait, and Sliding Window Protocol are examples of flow control protocols. Pure and Slotted ALOHA, CSMA, WDMA, IEEE 802.3 Standards and Frame Formats, CSMA/CD, Binary Exponential Back -off algorithm, Fast Ethernet, Gigabit Ethernet, IEEE 802.11a/b/g/n and IEEE 802.15 and IEEE 802.16 Standards, Frame formats, CSMA/CA.		
Mapping of Course Outcomes	CO3	
Unit IV	**Network Layer**	**(08 Hours)**
Switching techniques, IP Protocol, IPv4 and IPv6 addressing schemes, Subnetting, NAT, CIDR, ICMP, Routing Protocols: Distance Vector, Link State, Path Vector, Routing in Internet using Graphical Network System 3, Wireshark: RIP, OSPF, BGP, Congestion control and QoS, , MPLS, Mobile IP, Routing in MANET : AODV, DSR		
Mapping of Course Outcomes	CO4	
Unit V	**Transport Layer**	**(08 Hours)**
Services, Berkley Sockets, Addressing, Connection establishment and Port Numbers, Connection release, Flow control and buffering, Multiplexing, TCP, TCP Timer management, TCP Congestion Control, Real Time Transport protocol (RTP), Stream Control Transmission Protocol (SCTP), Quality of Service (QoS), Differentiated services, TCP and UDP for Wireless.		
Mapping of Course Outcomes	CO5	
Unit VI	**Application Layer**	**(08 Hours)**
Domain Name System (DNS), Hyper Text Transfer Protocol (HTTP), Email: SMTP, MIME, POP3, Webmail, FTP, TELNET, Dynamic Host Control Protocol (DHCP), Simple Network Management Protocol (SNMP).		
Mapping of Course Outcomes	CO4	

Methodology

The course will be covered through lectures, MOOCs courses and supported by practicals.

Reference Books:

1. Andrew S. Tenenbaum, “Computer Networks”, PHI, ISBN 81-203-2175-8.
2. Fourauzan B., "Data Communications and Networking", 5th Edition, Tata McGraw- Hill, Publications, ISBN: 0 – 07 – 058408
3. Kurose, Ross “Computer Networking a Top-Down Approach Featuring the Internet”, Pearson, ISBN-10: 0132856204 2.
4. Matthew S. G, “802.11 Wireless Networks”, O’Reilly publications, ISBN: 81-7656-992-5
5. C. Siva Ram Murthy and B. S. Manoj, “Ad Hoc Wireless Networks: Architectures and Protocols” Prentice

Hall, ISBN-10: 8131706885; ISBN-13: 978-8131706886
6. Holger Karl and Andreas Willing, “Protocols and Architectures for Wireless Sensor Networks”, Wiley India, ISBN: 9788126533695 5. Eldad Perahia, Robert Stacey, “Next Generation Wireless LANs”, Cambridge, ISBN-10: 1107016762; ISBN-13: 978-1107016767

Practical :

1. Create a point-to-point network with three nodes and duplex links between them. Set the queue size, change the bandwidth, and count how many packets are dropped.
2. Send ping messages/trace routes over a network with six nodes and count the number of packets lost due to congestion.
3. Create an Ethernet LAN with n nodes, various traffic nodes, and a congestion window for each source and destination.
4. Simulate the implementation of a simple ESS and transmitting nodes in a wire-free LAN and determine the performance in terms of packet transfer.
5. Test GSM performance on NS2/NS3 (using the MAC layer) or an analogous environment.
6. Implement CDMA on NS2/NS3 and examine its performance
7. Using CRC-CCITT, write a software to detect errors in code (16- bits).
8. Using the bellman-ford technique, create a software to discover the shortest path between vertices.
9. Create a client-server software that instructs the client to send the file name and instructs the server to return the contents of the requested file if it exists, using TCP/IP sockets.
10. Create a client/server datagram socket programme that displays messages typed on the server side on the client side (use Cisco Packet Tracer / NS-3, any other).

@The CO-PO Mapping Matrix

CO\ PO	PO1	PO2	PO3	PO4	PO 5	PO6	PO7	PO 8	PO9	PO1 0	PO1 1	PO 12
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CO 2	1	2	-	2	-	-	-	-	-	-	-	-
CO 3	2	1	2	1	-	-	-	-	-	-	-	-
CO 4	1	2	-	2	-	-	-	-	-	-	-	-
CO 5	-	-	2	-	-	-	-	-	-	-	-	-
CO 6	-	2	1	2	-	-	-	-	-	-	-	-
Co7	1	2	2	-	-	-	-	-	-	-	-	-

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PCC-AI 404: R Programming

Teaching Scheme	Credit Scheme	Examination Scheme and Marks
Lecture: 02 Hours/Week	03	Internal Assessment (TH): 40 Marks
Practical: 04 Hours/Week		End Semester (TH): 60 Marks

Course Objective:

The objective of the course is to familiarize the students with basic concept in R Programming.

1. To analysis data for the purpose of exploration using Descriptive and Inferential Statistics.
2. To understand Probability and Sampling Distributions and learn the creative application of Linear Regression in multivariate context for predictive purpose.
3. To define suitable data analysis workflows by interpreting simple R scripts
4. To summarize basic statistics used in data analysis and interpreting simple R programs.

Course Outcomes:

Upon completion of this course students will be able to:

CO1: To install, Code and Use R Programming Language in R Studio IDE to perform basic tasks on Vectors, Matrices and Data frames.

CO2: To describe key terminologies, concepts and techniques employed in Statistical Analysis.

CO3: To define, Calculate, Implement Probability and Probability Distributions to solve a wide variety of problems.

CO4: To conduct and Interpret a variety of Hypothesis Tests to aid Decision Making.

CO5: To understand, Analyse, Interpret Correlation and Regression to analyse the underlying relationships Between different variables.

CO6: Understand the concept of structured query language , xml and function.

Prerequisites:

Knowledge of C programming is required, basic understanding of Statistics & Data Structure

Unit I	**Introduction**	**(06 Hours)**
What exactly is R? R and R-Studio, Installation, R-Studio, Overview Functioning in the Console Arithmetic, Operators, Logical Procedures Making Use of Functions, Obtaining Assistance in R and Leaving R-Studio		
Mapping of Course Outcomes	CO1	
Unit II	**Operators, variables in R**	**(07 Hours)**
Variables, Numeric, Characteristic, and Logical Data, Vectors, Data Frames, Factors, Numeric, Character, and Factor Vector Sorting, Special Values		
Mapping of Course Outcomes	CO2	
Unit III	**Control Statements**	**(08 Hours)**

Home

If, if…else statement, if else () function, switch function, repeat loop, while loop, for loop, break statement, next statement, while loops, for loops, R Plot, R Line, R Pie Chart, R Bars

Mapping of Course Outcomes	CO3

Unit IV	**Data Types in R**	**(08 Hours)**

Creating Vectors, accessing elements of a Vector, Operations on Vectors, Vector Arithmetic, creating matrices, accessing matrices' elements Matrices operations, transpose a matrix Creating strings, copying, and pasting Using format to format integers and strings manipulation of strings Creating and modifying lists, as well as manipulating list elements combining lists, converting lists to vectors, Arrays are created, and array elements are accessed. Calculations between array components, data frame creation Data frame operations, data frame access, and data frame manipulation Putting together data frames from a variety of sources

Mapping of Course Outcomes	CO4

Unit V	**Statistics & Data Visualization**	**(08 Hours)**

Data visualization need. Bar Graph, Categorical data plotting Graph with stacked bars Line plot and histogram plot functions as pie chart / a three-dimensional pie chart

Scatter graph, Graph in a box, creating a working directory, Downloading, and importing data, working with missing data Extracting a subset of a data frame, Writing R scripts, Adding comments and documentation

Mapping of Course Outcomes	CO5

Unit VI	**Data and File Handling and SQL**	**(08 Hours)**

Reading and writing data: R CSV file, R Excel file, R XML file, R Database, Writing SQL statements in R Using the Select, From, Where Is, Like, Order By, Limit, Max, Min SQL functions, scripting, Introducing R-Studio and R-Studio-Cloud

Mapping of Course Outcomes	CO6

Reference Books:

1. Peng, R.D. (2020). R Programming for Data Science.
2. R in Action, By - Robert L. Kabacoff, Latest Edition – Second
3. R for Data Science , Hadley Wickham and Garrett Gorlemund, Latest Edition – First Publisher - O'Reilly
4. Phillips, N.D. (2018). YaRrr, The Pirate's Guide to R.
5. Grolemund, G. and Wickham, H. (2019). R for Data Science

Practical's:

1. Understand and manipulate strings (for example, substr() and scan()) & understand data indexing in vectors, matrices, and databases.
2. Write a program to check whether a year (integer) entered by the user is a leap year or not?
3. Create a program that prints the students' grades based on their grades. The following is how the marks should be graded:

Marks	Grades
800-1000	A+
700 – 800	A
500 – 700	B+
400-500	B
150 – 400	C
Less than 150	D

4. Create a simple calculator in R by using switch cases and functions to add, subtract, multiply, and divide.
5. Learn how loops work in R. Make your own vector loop.
6. For data manipulation, use if else statement. Contrast if else statement.
7. Make a list and a data frame that stores the grades for any three subjects for ten students. Determine the total, average, maximum, and minimum marks for each subject.
8. Outline the steps for importing data from Excel to CSV files and using data viewer functions such as rm(), dim(), head(), tail(), sorting, filtering, and searching to view a subset of rows.

@The CO-PO Mapping Matrix

CO\ PO	PO1	PO2	PO3	PO4	PO 5	PO6	PO7	PO 8	PO9	PO1 0	PO1 1	PO 12
CO	1	1	2	1	-	-	-	-	-	-	-	-
CO 2	1	2	-	2	-	-	-	-	-	-	-	-
CO 3	2	1	2	1	-	-	-	-	-	-	-	-
CO 4	1	2	-	2	-	-	-	-	-	-	-	-
CO 5	-	-	2	-	-	-	-	-	-	-	-	-
CO 6	-	2	1	2	-	-	-	-	-	-	-	-
Co7	1	2	2	-	-	-	-	-	-	-	-	-

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BT 203: Foundations of Data Science

Teaching Scheme	Credit Scheme	Examination Scheme and Marks
Lecture: 03 Hours/Week	03	Internal Assessment (TH): 40 Marks
Practical: 04 Hours/Week		End Semester (TH): 60 Marks

Course Objective:

The objective of this course is:

1. To understand the fundamentals of data science
2. To learn various data pre-processing and data collection techniques
3. To understand the process of data analytics and model building
4. To understand different tools and techniques of data visualization

Course Outcomes:

After completion of the course, learners should be able to

CO1: To understand the concept of data science and data science life cycle

CO2: To apply the pre-processing techniques for generating quality data inputs

CO3: To analyse the concept and parameters of exploratory data analytics

CO4: To develop the regression models using data science and analytics process

CO5: To analyse various tools and techniques of data visualization

CO6: handling data, encoding, tools apply, and types of data visualization.

Prerequisites:

Student should have a fundamental understanding of Fundamentals of Programming Languages (C, C++, and Java & Python) and a strong mathematical foundation.

Unit I	**Introduction**	**(07 Hours)**
Evolution of Data Science, Introduction to Data Science – Types of Data, Data Science Vs Big Data, Concept of Big Data, Concept of Data Warehousing, Introduction to Data Mining, Role of Data Scientist, Data Science Life Cycle, Data Science Roles – Data Science Project Stages – Data Science Applications in Various Fields – Data Security Issues, thinking in a structured way to solve data science problem statements.		
Mapping of Course Outcomes	CO1	
Unit II	**Pre-processing & collection of data**	**(08 Hours)**
Need of Data Pre-processing,Pre-processing of data and data collection, Data Pre-Processing Overview – Data Cleaning – Data Integration and Transformation – Data Reduction – Data Discretization, Data Storage, and management,Data preparation with Sandbox for analytics		
Mapping of Course Outcomes	CO2	
Unit III	**Exploratory Data Analytics**	**(08 Hours)**
Introduction to Data Analytics/Concept of Data Analytics Types of Data Analytics, Descriptive Statistics, Mean, Standard Deviation, Skewness, and Kurtosis, Box Plots, Pivot Table, Heat Map , Correlation Statistics , ANOVA , Exploratory Data Analytics, Confidence (statistical) intervals; variances and correlations		
Mapping of Course Outcomes	CO3	
Unit IV	**Regression & Model Development**	**(08 Hours)**

Simple and Linear Regression – Visual Model Evaluation – Residual Plot – Distribution Plot – Polynomial Regression and Pipelines – Residual Plot – Distribution Plot – Polynomial Regression and Pipelines – In-sample Evaluation Measures – Prediction and Decision Making		
Mapping of Course Outcomes	CO4	
Unit V	**Model Evaluation Generalization**	**(08 Hours)**
Metrics for Out-of-Sample Evaluation Error – Cross Validation – Overfitting – Under fitting and Model Selection – Ridge Regression Prediction – Grid Search Testing Multiple Parameters		
Mapping of Course Outcomes for Unit V	CO5	
Unit VI	**Data Visualization**	**(06 Hours)**
Data handling /Data wrangling using Python Definition, Types of visualization, data visualization, Data types, Data encoding , mapping variables , Conventional data visualization tools, Techniques for visual data representations, Types of data visualization		
Mapping of Course Outcomes	CO6	

Methodology:

The course will be covered through lectures, videos, MOOC courses and practical.

Reference Book:

.G. Strang . Introduction to Linear Algebra, Wellesley-Cambridge Press, Fifth edition, USA, 2016.
2. Bendat, J. S. and A. G. Piersol. Random Data: Analysis and Measurement Procedures. 4th Edition. John Wiley & Sons, Inc., NY, USA, 2010
3. Montgomery, D. C. and G. C. Runger. Applied Statistics and Probability for Engineers. 5th Edition. John Wiley & Sons, Inc., NY, USA, 2011.
4. David G. Luenberger . Optimization by Vector Space Methods, John Wiley & Sons (NY), 1969.
5. Cathy O'Neil and Rachel Schutt . Doing Data Science, O'Reilly Media, 2013.
6.Jojo Moolayil, "Smarter Decisions : The Intersection of IoT and Data Science", PACKT, 2016.
7.Cathy O'Neil and Rachel Schutt , "Doing Data Science", O'Reilly, 2015.
8. David Dietrich, Barry Heller, Beibei Yang, "Data Science and Big data Analytics", EMC 2013

Practicals

1 Determine the need for data science and use Python's built-in data types and techniques to tackle basic challenges.
2 Using the OOP paradigm, create an application with user-defined modules and packages. Install, configure and run Hadoop and HDFS
3 Use NumPy arrays for efficient storage and data operations.
4. Use Python Data Structures, Intrinsic NumPy objects, and Random Functions to create NumPy arrays.
5. NumPy array manipulation (indexing, slicing, reshaping, joining, and splitting).
6. Using Universal Functions and Mathematical Methods to compute on NumPy arrays
7. Import any CSV file into a Pandas Data Frame and run the following commands:
   (a) Visualize the first and last 10 records
   (b) Determine the shape, index, and column details
   (c) Select/Delete records (rows)/columns based on circumstances

@The CO-PO Mapping Matrix

CO\ PO	PO1	PO2	PO3	PO4	PO 5	PO6	PO7	PO 8	PO9	PO1 0	PO1 1	PO 12
CO	1	1	2	1	-	-	-	-	-	-	-	-
CO 2	1	2	-	2	-	-	-	-	-	-	-	-
CO 3	2	1	2	1	-	-	-	-	-	-	-	-
CO 4	1	2	-	2	-	-	-	-	-	-	-	-
CO 5	-	-	2	-	-	-	-	-	-	-	-	-
CO 6	-	2	1	2	-	-	-	-	-	-	-	-
Co7	1	2	2	-	-	-	-	-	-	-	-	-

SEMESTER - V

SEMESTER V						
Course Code	**Course Name**	**L**	**T**	**P**	**Hr**	**Cr**
PCC-AI 501	Big data analytics	3	0	2	5	4
PCC-AI 502	Machine Learning	3	0	2	5	4
PCC-AI 503	Web Technology	3	0	2	5	4
PCC-AI 504	Design and Analysis of Algorithm	3	0	0	3	3
PEC-AI 501	Elective-I	3	0	0	3	3
PEC-AI 502	Skill Enhancement Course-I	2	0	0	2	2
Total		**16**	**0**	**12**	**23**	**20**

Elective I (A-Human Computer Interface, B-System modeling and Design, C-Pattern Recognition, D-Structural Biology and Bioinformatics)

Skill Enhancement Course I : Language-I: (Foreign Language (French/German/Japanese)/ Hindi/Marathi)

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PCC-AI 501: Big Data and Analytics

Teaching Scheme	Credit Scheme	Examination Scheme and Marks
Lecture: 03 Hours/Week	**04**	**Internal Assessment (TH): 40** End Semester (TH): 60

Prerequisites: Students must have fundamental knowledge of data structures & SQL queries

Course Objectives:

1. Understand the Big Data Platform and its Use cases
2. Provide an overview of Apache Hadoop
3. Provide HDFS Concepts and Interfacing with HDFS
4. Understand Map Reduce Jobs
5. Provide hands on Hodoop Eco System
6. Apply analytics on Structured, Unstructured Data.

Course Outcomes:

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

CO 1. Outline the significance and challenges of big data
CO 2. Model big data using different totals and frameworks
CO 3. Apply big data techniques for useful business analytic applications
CO 4. Design algorithms for mining the data from large volumes
CO 5 Evaluate and select appropriate tools and technologies for handling big data
CO 6. Interpret and communicate the insights gained from big data analysis

Course Contents

Unit I	**Introduction**	**(06 Hours)**
Evolution of Big Data, Types of Digital Data. Classification of Digital Data, Structured Data. Semi-Structured Data. Unstructured Data, Definition of Big Data, Challenges of Conventional Systems, Big data platforms and data storage.		
Mapping of Course Outcomes	CO1	
Unit II	**Big Data Analytics**	**(08 Hours)**
Importance of Big data analytics, Classification of Analytics, Top Challenges Facing Big data, Technologies to meet the Challenges Posed Big Data. Terminologies Used in Big Data Environment		
Mapping of Course Outcomes	CO2	
Unit III	**Hadoop**	**(06 Hours)**
Introducing History of Hadoop, comparisons of RDBMS and Hadoop, Distributed Computing Challenges, **Hadoop Overview**, Business Value of Hadoop, Processing Data with Hadoop, Hadoop Streaming, Hadoop Echo System. Hadoop in the Cloud, Applications on Big Hadoop Ecosystem		
Mapping of Course Outcomes	CO3	
Unit IV	**HDFS(Hadoop Distributed File System) & Map Reduce**	**(10 Hours)**
HDFS(Hadoop Distributed File System) The Design of HDFS, HDFS Concepts, Command Line Interface, Hadoop file system interfaces, Data flow, Data Ingest with Flume and Scoop and Hadoop archives, **Hadoop I/O**: Compression, Serialization, Avro and File-Based Data structures. **Map Reduce** Anatomy of a Map Reduce Job Run, Failures, Job Scheduling, Shuffle and Sort, Task Execution, Map Reduce Types and Formats, Map Reduce Features		
Mapping of Course Outcomes	CO4	

Unit V	Hadoop EcoSystem	(06 Hours)
Pig: Introduction to PIG, Execution Modes of Pig, Comparison of Pig with Databases, Grunt, Pig Latin, User Defined Functions, Data Processing operators. **Hive:** Hive Shell, Hive Services, Hive Metastore, Comparison with Traditional Databases, HiveQL, Tables, Querying Data and User Defined Functions. **Hbase:** HBasics, Concepts, Clients, Example, Hbase Versus RDBMS. **Big SQL:** Introduction		
Mapping of Course Outcomes	CO5	

Unit VI	The Big Data Technology Landscape & Algorithms	(09 Hours)
CAP Theorem – BASE. Concept, NoSQL, Types of No SQL databases, Introduction to MongoDB, Data Types in MongoDB. Applying Linear Regression, Clustering, Association rule mining. Decision tree on Big Data. Introduction to IBM InfoSphere BigInsights		
Mapping of Course Outcomes	CO6	

List of Practical

1. Learning limitation of data analytics by applying Machine Learning Techniques on large amount of data. Write R/Python program to Read data set from any online website, excel file and CSV file and to perform
   a) Linear regression and logistic regression on iris dataset.
   b) K-mcans clustcring.
2. Setup single node Hadoop cluster and apply HDFS commands on single node Hadoop Cluster. (*students can setup multimode cluster in laboratory)
3. Apply MapReduce algorithms to perform analytics on single node cluster:
   a) Analyze phrase frequency from given dataset
   b) Search Records with matching criteria
   c)Aggregate inputs and search records based on aggregation
4. Analyze impact of different number of mapper and reducer on same definition as practical 3.
5. Setup the MongoDB environment in your system. Import Restaurant Dataset and perform CRUD operation.
6. Extend MongoDB functionality for MapReduce on document collection
7. SPark SQL and MLLib:
   (i) PYspark shell exploration and reading and writing in HDFS
   (ii) Clustering using MLlib, compare results of clustering with Hadoop MR and with Spark
8. Identify a case study to perform analytics on different platforms (like NoSQLs, Spark, Zookeeper and ‹analyse differences.

Learning Resources

Reference Books:

1. Seema Acharya, Subhasini Chellappan, "Big Data Analytics" Wiley 2015
2. Tone White, Tone White, Hadoop: The Definitive Guide, O'reilly Media Chris Eaton, Dirk DeRoos, Tom Deutsch, George Lapis, Paul Zikopoulos.
3. Chris Eaton, Dirk DeRoos, Tom Deutsch, George Lapis, Paul Zikopoulos. "Understanding Big Data: Analytics for Enterprise Class Hadoop and Streaining Data". McGraw Hill Publishing
4. Bill Franks, Taming the Big Data Tidal Wave: "Finding Opportunities in Huge Data Streams with Advanced Analytics, John Wiley & sons
5. Paul Zikopoulos. Dirk deRoos, Krishnan Parasuraman, Thomas Deutsch, James Giles. David Corrigan, "Harness the Power of Big Data" the IBM Big Data Platform, Tata McGraw Hill Publications
6.Michael Minelli, Michele Chambers, Ambiga Dhiraj, Big Data, Big Analytics: Emerging Business Intelligence and Analytic Trends for Today's Businesses, Wiley Publications

eBooks:

1. Big Data: A Revolution That Will Transform How We Live, Work, and Think" by Viktor Mayer-Schönberger and Kenneth Cukier.
2. "The Big Data-Driven Business: How to Use Big Data to Win Customers, Beat Competitors, and Boost Profits" by Russell Glass and Sean Callahan.
3. "Data Science for Business: What You Need to Know about Data Mining and Data-Analytic Thinking" by Foster Provost and Tom Fawcett.

"Big Data: Understanding How Data Powers Big Business" by Bill Schmarzo.

MOOC/ Video Lectures available at:

1. https://onlinecourses.swayam2.ac.in/
2. Coursera: Coursera offers a wide range of courses on Big Data and Analytics, including "Big Data Specialization" by University of California, San Diego and "Data Science and Machine Learning Bootcamp with R" by Johns Hopkins University.

@The CO-PO Mapping Matrix

CO\ PO	PO 1	PO 2	PO 3	PO 4	PO 5	PO 6	PO 7	PO 8	PO 9	PO 10	PO 11	PO 12
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CO5	-	-	2	-	-	-	-	-	-	-	-	-
CO6	-	2	1	2	-	-	-	-	-	-	-	-

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PCC-AI 502: Machine Learning

Teaching Scheme	Credit Scheme	Examination Scheme and Marks
Lecture: 03 Hours/Week	**04**	**Internal Assessment (TH): 40**
		End _Semester (TH): 60

Prerequisites: Students must have knowledge of linear algebra, calculus, programming skills, probability, and statistics. Students also must have fundamental knowledge of Artificial Intelligence

Course Objectives:

1. To understand the basic theory underlying machine learning.
2. To be able to formulate machine learning problems corresponding to different applications.
3. To understand a range of machine learning algorithms along with their strengths and weaknesses.
4. To be able to apply machine learning algorithms to solve problems of moderate complexity.
5. To apply the algorithms to a real-world problem, optimize the models learned, and report on the expected accuracy of the models.

Course Outcomes:

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

CO 1. To appreciate the significance of modelling in data analytics solutions.
CO 2. To apply structured thinking to unstructured problems
CO 3. To demonstrate how to evaluate models generated from data
CO 4. To develop an appreciation for what is involved in learning models from data
CO 5. To apply the algorithms to a real problem, optimize the models learned.
CO 6. To apply dimensionality reduction techniques to effectively analyze and extract valuable insights from high-dimensional datasets.

Course Contents

Unit I	**Introduction**	**(02 Hours)**
Overview Of Machine Learning, Related Areas, Applications, Software Tools. Different Paradigms of Machine Learning.		
Mapping of Course Outcomes	CO1	
Unit II	**Supervised Learning**	**(07 Hours)**
Artificial Neural Network, Classifying with k-Nearest Neighbors, Splitting datasets one feature at a time: decision trees, Classifying with probability theory: naive Bayes, Logistic regression, Support vector machines, Improving classification with the AdaBoost meta algorithm.		
Mapping of Course Outcomes	CO2	
Unit III	**Unsupervised Learning**	**(07 Hours)**
Association analysis with the Apriori algorithm, K-means clustering, expectation maximization, Gaussian mixture density estimation, mixture of naive Bayes, model selection.		
Mapping of Course Outcomes	CO2	
Unit IV	**Reinforcement learning**	**(07Hours)**

Markov decision process (MDP), Bellman equations, Value iteration and policy iteration, Linear quadratic regulation (LQR), Linear Quadratic Gaussian (LQG), Q-learning, Value function approximation, Policy search, POMDPs.		
Mapping of Course Outcomes	CO3, CO4	
Unit V	**Forecasting and Learning Theory**	**(07 Hours)**
Predicting numeric values: regression, Tree-based regression. Bias/variance tradeoff, Union and Chernoff/Hoeffding bounds, Vapnik–Chervonenkis (VC) dimension, Worst case (online) learning, Practical advice on how to use learning algorithms.		
Mapping of Course Outcomes	CO5	
Unit VI	**Neural networks & Dimentionality Reduction**	**(08 Hours)**
The perceptron algorithm, multilayer perceptrons, backpropagation, nonlinear regression, multiclass discrimination, training procedures, localized network structure, deep neural networks. Feature selection, principal component analysis, linear discriminant analysis, factor analysis, independent component analysis, multidimensional scaling, and manifold learning.		
Mapping of Course Outcomes	CO6	

List of Practical

1. Write a program to learn a decision tree. Decision tree learning should use information gain as the criterion for choosing the attribute for splitting. Tree pruning should not be performed. The tree should be tested on few test samples. The tree structure should be printed as output.
2. Write a program to learn a naïve Bayes classifier and use it to predict class labels of test data. The learned classifier should be tested on test instances with unknown class labels and the predicted class labels for the test instances should be printed as output
3. Write a program to implement the Adaboost algorithm with decision tree as the base classifier. The decision tree implemented in Assignment 1 may be called as a function. Run Adaboost for 3 rounds. The combined classifier should be tested on test instances and the accuracy of prediction for the test instances should be printed as output. A single program should train the classifier on the training set as well as test it on the test set.
4. Write a program to cluster a set of points using K-means. Consider, K=2, clusters. Also, consider Euclidean distance as the distance measure. Randomly initialize a cluster mean as one of the data points. Iterate for 10 iterations. After iterations are over, print the final cluster numbers for each of the data points.
5. Write a program to use a K-nearest neighbor it to predict class labels of test data. Euclidean distance should be used as the distance metric. Consider K=5. The learned classifier should be tested on test instances with unknown class labels, and the predicted class labels for the test instances should be printed as output.
6. Spam email classification using Support Vector Machine: In this assignment you will use a SVM to classify emails into spam or non-spam categories. And report the classification accuracy for various SVM parameters and kernel functions. You have to submit the report file in pdf format.
7. Write a program to train a single perceptron using the delta learning rule. Consider learning rate to be 0.1. (You may also try to find out a better learning rate by trial.) Randomly initialize the weights of the perceptron. Train the perceptron for 10 epochs. Then, the learned classifier should be tested on test instances with unknown class labels, and the predicted class labels for the test instances should be printed as output.

Learning Resources

Text Books:

1. Machine Learning, E. Alpaydin, MIT Press, 2010..
2. C. M. Bishop. Pattern Recognition and Machine Learning. First Edition. Springer, 2006. (Second Indian Reprint, 2015).

3. P. Flach. Machine Learning: The Art and Science of Algorithms that Make Sense of Data. First Edition, Cambridge University Press, 2012.
4. Machine Learning: A Probabilistic Perspective, K. Murphy, MIT Press, 2012.
5. Pattern Classification, R. Duda, E. Hart, and D. Stork, Wiley-Interscience, 2000.
6. Machine Learning, T. Mitchell, McGraw-Hill, 1997.
7. The Elements of Statistical Learning - Hastie, Tibshirani, Friedman
8. Machine Learning - Tom Mitchell (TM)

eBooks:

1. “Hands-On Machine Learning with Scikit-Learn, Keras, and TensorFlow" by Aurélien Géron.
2. "Pattern Recognition and Machine Learning" by Christopher M. Bishop.
3. "Machine Learning Yearning" by Andrew Ng.

MOOC/ Video Lectures available at:

1. Coursera: Coursera offers a wide range of machine learning courses, including the famous "Machine Learning" course by Andrew Ng. It covers the fundamentals of machine learning and is highly recommended for beginners.
2. edX: edX provides courses on machine learning from prestigious institutions like Harvard, MIT, and Microsoft. One popular course is "Introduction to Artificial Intelligence" by IBM.

@The CO-PO Mapping Matrix

CO\ PO	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12
CO1	1	1	2	1	-	-	-	-	-	-	-	-
CO2	1	2	-	2	-	-	-	-	-	-	-	-
CO3	2	1	2	1	-	-	-	-	-	-	-	-
CO4	1	2	-	2	-	-	-	-	-	-	-	-
CO5	-	-	2	-	-	-	-	-	-	-	-	-
CO6	-	2	1	2	-	-	-	-	-	-	-	-

Dr D. Y. Patil School of Science &Technology,
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PCC-AI 503: Web Technology

Teaching Scheme	Credit Scheme	Examination Scheme and Marks
Lecture: 03 Hours/Week	**04**	**Internal Assessment (TH): 40**
		End _Semester (TH): 60

Prerequisites: Basic knowledge of Data Structures and Algorithms, Discrete Mathematics is required.

Objectives:

1. Translate user requirements into the overall architecture and implementation of new systems and Manage Project and coordinate with the Client
2. Write backend code in PHP language and Writing optimized frontend code HTML and JavaScript
3. Understand, create and debug database related queries and Create test code to validate the applications against client requirement
4. Monitor the performance of web applications & infrastructure and Troubleshooting web application with a fast and accurate a resolution

Course Outcomes:

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

CO 1. To gain knowledge of client-side scripting, validation of forms
CO 2. To understand server-side scripting with PHP language
CO 3. To understand what is XML and how to parse and use XML Data with Java
CO 4. To introduce Server-side programming with Java Servlets and JSP
CO 5. To develop dynamic web applications using client-side scripting with JavaScript.
CO 6. To implement AJAX programming techniques to enhance the interactivity of web applications.

Course Contents

Unit I	**Introduction to PHP**	**(08 Hours)**
Declaring variables, data types, arrays, strings, operators, expressions, control structures, functions, Reading data from web form controls like text boxes, radio buttons, lists etc., Handling File Uploads. Connecting to database (MySQL as reference), executing simple queries, handling results, Handling sessions and cookies. File operations like opening, closing, reading, writing, appending, deleting etc. on text and binary files, listing directories.		
Mapping of Course Outcomes	CO2	
Unit II	**HTML Common tags**	**(08 Hours)**
HTML Common tags-List, Tables, images, forms, Frames; Cascading Style sheets; XML: Introduction to XML, Defining XML tags, their attributes and values, Document Type Definition, XML Schemes, Document Object Model, XHTML Parsing XML Data – DOM and SAX Parsers in java.		
Mapping of Course Outcomes	CO1	
Unit III	**Introduction to Servlets**	**(08 Hours)**
Common Gateway Interface (CGt), Life cycle of a Servlet, deploying a servlet, The Servlet API, Reading Servlet parameters, Reading Initialization parameters, Handling Http Request & Responses, Using Cookies and Sessions, connecting to a database using JDBC.		
Mapping of Course Outcomes	CO3	
Unit IV	**Introduction to JSP**	**(08Hours)**

The Anatomy of a JSP Page, JSP Processing, Declarations, Directives, Expressions, Code Snippets, implicit objects, Using Beans in JSP Pages, Using Cookies and session for session tracking, connecting to database in JSP.		
Mapping of Course Outcomes	CO4	
Unit V	**Client-side Scripting**	**(08 Hours)**
Introduction to Javascript, Javascript language – declaring variables, scope of variables, functions, event handlers (onclick, onsubmit etc.), Document Object Model, Form validation.		
Mapping of Course Outcomes	CO5	
Unit VI	**Dynamic Web Applications with AJAX**	**(08 Hours)**
Introduction to AJAX (Asynchronous JavaScript and XML), AJAX architecture, XMLHttpRequest object, handling server responses asynchronously, updating web page content dynamically without reloading the entire page, working with JSON data, implementing AJAX in web applications.		
Mapping of Course Outcomes	CO6	

List of Practical:

1. Design the following static web pages required for an online bookstore website.
    1. HOME PAGE: The static home page must contain three frames
    2. LOGIN PAGE
    3. CATOLOGUE PAGE: The catalogue page should contain the details of all the books available on the website in a table.
    4. REGISTRATION PAGE
2. Write JavaScript to validate the following fields of the Registration page.
    1. First Name (Name should contains alphabets and the length should not be less than 6 characters).
    2. Password (Password should not be less than 6 characters length).
    3. E-mail id (should not contain any invalid and must follow the standard pattern name@domain.com)
    4. Mobile Number (Phone number should contain 10 digits only).
    5. Last Name and Address (should not be Empty).
3. Develop and demonstrate the usage of inline, internal and external style sheet using CSS.
4. Develop and demonstrate JavaScript with POP-UP boxes and functions for the following problems:
    1. Input: Click on Display Date button using onclick( ) function Output: Display date in the textbox
    2. Input: A number n obtained using prompt Output: Factorial of n number using alert
    3. Input: A number n obtained using prompt Output: A multiplication table of numbers from 1 to 10 of n using alert
    4. Input: A number n obtained using prompt and add another number using confirm Output: Sum of the entire n numbers using alert
5. Write an HTML page that contains a selection box with a list of 5 countries. When the user selects a country, its capital should be printed next in the list. Add CSS to customize the properties of the font of the capital (color,bold and font size).
6. Write an HTML page including any required JavaScript that takes a number from text field in the range of 0 to 999 and shows it in words. It should not accept four and above digits, alphabets and special characters.
7. Develop and demonstrate PHP Script for the following problems:
    1. Write a PHP Script to find out the Sum of the Individual Digits.
    2. Write a PHP Script to check whether the given number is Palindrome or not.

8. Create an XML document that contains 10 users information. Write a Java Program, which takes User Id as input and returns the user details by taking the user information from XML document using DOM parser or SAX parser.
9. Implement web applications using (a) PHP, (b) Servlets and (c) JSP.

Learning Resources

Text Books:

1. 1. Web Technologies, Uttam K Roy, Oxford University Press
2. The Complete Reference PHP — Steven Holzner, Tata McGraw-Hill

ebooks:

1. Web Programming, building internet applications, Chris Bates 2″ edition, Wiley Dreamtech
2. Java Server Pages —Hans Bergsten, SPD O'Reilly,
3. Java Script, D.Flanagan
4. Beginning Web Programming-Jon Duckett WROX.
5. Programming world wide web, R.W.Sebesta, Fourth Edition, Pearson.
6. Internet and World Wide Web — How to program. Dietel and Nieto, Pearson.

MOOC/ Video Lectures available at:

1. Coursera (www.coursera.org): Coursera offers a wide range of courses from top universities and institutions. You can find courses on web development, HTML, CSS, JavaScript, and more.
2. edX (www.edx.org): edX provides courses from renowned universities and organizations. It offers courses on web development, front-end development, full-stack development, and related topics.

@The CO-PO Mapping Matrix

CO\ PO	PO 1	PO 2	PO 3	PO 4	PO 5	PO 6	PO 7	PO 8	PO 9	PO 10	PO 11	PO12
CO 1	1	1	2	1	-	-	-	-	-	-	-	-
CO 2	1	2	-	2	-	-	-	-	-	-	-	-
CO 3	2	1	2	1	-	-	-	-	-	-	-	-
CO 4	1	2	-	2	-	-	-	-	-	-	-	-
CO 5	-	-	2	-	-	-	-	-	-	-	-	-
CO 6	-	2	1	2	-	-	-	-	-	-	-	-

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PCC-AI 504: Design and Analysis of Algorithm

Teaching Scheme	Credit Scheme	Examination Scheme and Marks
Lecture: 03 Hours/Week	**03**	**Internal Assessment (TH): 40**
		End_Semester (TH): 60

Prerequisites: Discrete Mathematics, Data Structure and Algorithms

Objectives:

1. To develop problem solving abilities using mathematical theories
2. To analyze the performance of algorithms
3. To study algorithmic design strategies

Course Outcomes:

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

CO 1. To identify the problem, design the algorithm and confirm the correctness of algorithm
CO 2. Apply and analyze greedy and dynamic programming algorithmic design techniques
CO 3. Apply and analyze Abstract algorithm
CO 4. Analyze the asymptotic performance of algorithms
CO 5. Analyze the amortized algorithms.
CO 6. Analyze the multithreaded and distributed algorithms.

Course Contents

Unit I	**Fundamentals**	**(07 Hours)**
The Role of Algorithms in Computing - What are algorithms, Algorithms as technology, Evolution of Algorithms, Design of Algorithm, Need of Correctness of Algorithm, Confirming correctness of Algorithm – sample examples, Iterative algorithm design issues		
Mapping of Course Outcomes	CO1	
Unit II	**Models and Design**	**(07 Hours)**
Functional Model – Features, Recursive processes, Scope rules, Tail recursion, Checking correctness of Iterative process. Imperative Model – Basics, Specifications and Prototyping, Stepwise Refinement, Proof Rules – Basics, For loops, Goto and Exit loops, Functions and Procedures, Problem Solving using Greedy strategy - Knapsack problem, Huffman code generation algorithm.		
Mapping of Course Outcomes	CO2	
Unit III	**Abstract Algorithms**	**(07 Hours)**
Dynamic Programming, Divide and Conquer, Greedy strategy, Branch-n-Bound, Natural Algorithms – Evolutionary Algorithms and Evolutionary Computing, Introduction to Genetic Algorithm, Simulated Annealing, Artificial Neural Network and Tabu Search.		
Mapping of Course Outcomes	CO3	
Unit IV	**Complexity Theory**	**(07 Hours)**
Complexity theory – Counting Dominant operators, Growth rate, upper bounds, asymptotic growth, O, Ω, Θ, o and ω notations, polynomial and non-polynomial problems, deterministic and nondeterministic algorithms, P-class problems, NP-class of problems, Polynomial problem reduction NP complete problems- vertex cover and 3-SAT and NP hard problem – Hamiltonian cycle.		
Mapping of Course Outcomes	CO4	

Home

Unit V	Amortized Analysis	(07 Hours)
Amortized Analysis – Binary, Binomial and Fibonacci heaps, Dijkstra's Shortest path algorithm, Splay Trees, Time-Space tradeoff, Introduction to Tractable and Non-tractable Problems, Introduction to Randomized and Approximate algorithms, Embedded Algorithms: Embedded system scheduling (power optimized scheduling algorithm), sorting algorithm for embedded systems.		
Mapping of Course Outcomes	CO5	
Unit VI	**Multithreaded and Distributed Algorithms**	**(07 Hours)**
Multithreaded Algorithms - Introduction, Performance measures, Analyzing multithreaded algorithms, Parallel loops, Race conditions. Problem Solving using Multithreaded Algorithms - Multithreaded matrix multiplication, Multithreaded merge sort. Distributed Algorithms - Introduction, Distributed breadth first search, Distributed Minimum Spanning Tree. String Matching- Introduction, The Naive string matching algorithm, The Rabin-Karp algorithm		
Mapping of Course Outcomes	CO6	

Learning Resources

Text Books:

1. Parag Himanshu Dave, Himanshu Bhalchandra Dave, Design And Analysis of Algorithms, Pearson Education, ISBN 81-7758- 595-9
2. Gilles Brassard, Paul Bratley, Fundamentals of Algorithmics, PHI, ISBN 978-81-203-1131-2

Reference Books:

1. Michael T. Goodrich, Roberto Tamassia , ―Algorithm Design: Foundations, Analysis and Internet Examples‖, Wiley, ISBN 978-81-265-0986-7
2. Thomas H. Cormen, Charles E. Leiserson, Ronald L. Rivest and Clifford Stein,―Introduction to Algorithms‖, MIT Press; ISBN 978-0-262-03384-8
3. Horowitz and Sahani, "Fundamentals of Computer Algorithms", University Press, ISBN:978 81 7371 6126, 81 7371 61262
4. Rajeev Motwani and Prabhakar Raghavan, ―Randomized Algorithms‖, Cambridge University Press, ISBN: 978-0-521-61390-3
5. Dan Gusfield, ―Algorithms on Strings, Trees and Sequences‖, Cambridge University Press,ISBN:0-521-67035-7

eBooks:

1. "Introduction to the Design and Analysis of Algorithms" by Anany Levitin
2. "Algorithms" by Robert Sedgewick and Kevin Wayne
3. "The Algorithm Design Manual" by Steven S. Skiena

MOOC/ Video Lectures available at:

1. Coursera: Coursera offers a range of algorithm courses, including "Algorithms, Part I" and "Algorithms, Part II" by Princeton University. These courses cover fundamental algorithms and data structures.
2. edX: edX provides courses on algorithm design and analysis from renowned institutions. "Algorithms and Data Structures" by Microsoft and "Design and Analysis of Algorithms" by IIT Bombay are popular choices.

@The CO-PO Mapping Matrix

CO\ PO	PO 1	PO 2	PO 3	PO 4	PO 5	PO 6	PO 7	PO 8	PO 9	PO 10	PO 11	PO 12
CO1	1	1	2	1	-	-	-	-	-	-	-	-
CO2	1	2	-	2	-	-	-	-	-	-	-	-
CO3	2	1	2	1	-	-	-	-	-	-	-	-
CO4	1	2	-	2	-	-	-	-	-	-	-	-
CO5	-	-	2	-	-	-	-	-	-	-	-	-
CO6	-	2	1	2	-	-	-	-	-	-	-	-
CO7	1	2	2	-	-	-	-	-	-	-	-	-

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PEC-AI 501 (A): Elective 1: Human Computer Interface

Teaching Scheme	Credit Scheme	Examination Scheme and Marks
Lecture: 03 Hours/Week	**03**	**Internal Assessment (TH): 40**
		End_Semester (TH): 60

Prerequisites: Web Technologies; Software Engineering; Experience in designing interfaces for applications and web sites. Basic knowledge of designing tools and languages like HTML, Java, etc

Objectives:

1. Understand the important aspects of implementation of human-computer interfaces.
2. Identify the various tools and techniques for interface analysis, design, and evaluation.
3. Identify the impact of usable interfaces in the acceptance and performance utilization of information systems

Course Outcomes:

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

CO 1 Identify User Interface (UI) design principles.
CO 2 Analysis of effective user friendly interfaces.
CO 3. Apply Interactive Design process in real world applications.
CO 4. Evaluate UI design and justify.
CO 5. Create application for social and technical task.
CO 6. Apply principles of User Interface (UI) design to develop effective and user-friendly web interfaces

Course Contents

Unit I	**Foundations of HMI**	**(10 Hours)**
The Human: History of User Interface Designing, I/O channels, Hardware, Software and Operating environments, The Psychopathology of everyday Things, Psychology of everyday actions, Reasoning and problem solving. The computer: Devices, Memory, processing and networks. Interaction: Models, frameworks, Ergonomics, styles, elements, interactivity		
Mapping of Course Outcomes	CO1	
Unit II	**Interaction Design Basics**	**(08 Hours)**
What is design?, The process of design, User focus, Cultural probes, Navigation design, the big button trap, Modes, Screen design and layout, Alignment and layout matters, Checking screen colors, Iteration and prototyping Principles to support usability, Standards, Guidelines, HCI patterns.		
Mapping of Course Outcomes	CO2	
Unit III	**Graphical User Interface**	**(04 Hours)**
The graphical User Interface: Popularity of graphics, the concept of direct manipulation, graphical systems, Characteristics.		
Mapping of Course Outcomes	CO3	
Unit IV	**Screen Designing**	**(08 Hours)**
Design goals , Screen planning and purpose, organizing screen elements, ordering of screen data and content , screen navigation and flow, Visually pleasing composition, amount of information, focus and emphasis, presentation information simply and meaningfully		

Mapping of Course Outcomes	CO4	
Unit V	**Interface Design for Mobile Device**	**(06 Hours)**
Mobile Ecosystem: Platforms, Application frameworks: Types of Mobile Applications: Widgets, Applications, Games, Mobile Information Architecture, Mobile 2.0, Mobile Design: Elements of Mobile Design,		
Mapping of Course Outcomes	CO5	
Unit VI	**Web User Interface**	**(06 Hours)**
Interface popularity, characteristics. The merging of graphical Business systems and the Web. Principles of user interface. , information retrieval on web, statistical graphics, Technological consideration in interface		
Mapping of Course Outcomes	CO6	
Learning Resources		

Reference Books:

1. Alan Dix, Janet Finlay, Gregory Abowd, Russell Beale, Human Computer Interaction, 3rd Edition, Pearson Education, 2004.
2. Wilbert O. Galitz, The Essential Guide to User Interface Design, Wiley publication.
3. Alan Cooper, Robert Reimann, David Cronin, About Face3: Essentials of Interaction design, Wiley publication.
4. Jeff Johnson, Designing with the mind in mind, Morgan Kaufmann Publication.
5. Donald A. Normann, Design of everyday things, Basic Books; Reprint edition 2002.
6. Brian Fling, Mobile Design and Development, First Edition , OReilly Media Inc., 2009.

eBooks:

1. Don't Make Me Think, Revisited: A Common Sense Approach to Web Usability" by Steve Krug.
2. "The Design of Everyday Things" by Don Norman.
3. "Designing Interfaces: Patterns for Effective Interaction Design" by Jenifer Tidwell.

MOOC/ Video Lectures available at:

1. Coursera: Coursera offers various UI/UX design courses from top universities and industry professionals. You can explore courses such as "Interaction Design Specialization" by UC San Diego, "UI / UX Design" by CalArts, or "Designing the User Experience: User Interface Design Basics" by Georgia Tech.
2. Udemy: Udemy has a wide range of UI/UX design courses, including "User Experience Design Essentials - Adobe XD UI UX Design" and "UI Design with Photoshop from Scratch" among many others.

CO-PO Mapping Matrix

CO\ PO	PO 1	PO 2	PO 3	PO 4	PO 5	PO 6	PO 7	PO 8	PO 9	PO 10	PO 11	PO 12
CO1	1	1	2	1	-	-	-	-	-	-	-	-
CO2	1	2	-	2	-	-	-	-	-	-	-	-
CO3	2	1	2	1	-	-	-	-	-	-	-	-
CO4	1	2	-	2	-	-	-	-	-	-	-	-
CO5	-	-	2	-	-	-	-	-	-	-	-	-
CO6	-	2	1	2	-	-	-	-	-	-	-	-
CO7	1	2	2	-	-	-	-	-	-	-	-	-

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PEC-AI 501 (B): Elective 1: System modeling and Design

Teaching Scheme	Credit Scheme	Examination Scheme and Marks
Lecture: 03 Hours/Week	**03**	**Internal Assessment (TH): 40**
		End_Semester (TH): 60

Prerequisites: Programming Foundations, Applied Statistics and Statistics for Engineers

Course Objectives: The objective of this course is:

1. The course has been designed to provide a solid foundation of systems principles
2. An understanding of how business function,
3. Heightening students to the issues analysts face daily.

Course Outcomes:

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

CO 1. To provide a better understanding of how systems operate
CO 2. To respond to change by modeling, simulating, and analyzing performance.
CO 3. To apply systems modeling and simulation techniques to analyze the performance
CO 4. To demonstrate proficiency in systems analysis and documentation
CO 5. To design and model systems using appropriate techniques
CO 6. To implement and maintain systems

Course Contents

Unit I	**Introduction**	**(08 Hours)**
System definition and concepts: Characteristics and types of system, Manual and automated systems Real-life Business sub-systems: Production, Marketing, Personal, Material, Finance Systems models types of models: Systems environment and boundaries, Real-time and distributed systems, Basic principles of successful systems		
Mapping of Course Outcomes		
Unit II	**Systems analyst & System Development cycle**	**(08 Hours)**
Role and need of systems analyst ,Qualifications and responsibilities ,Systems Analyst as and agent of change, Introduction to systems development life cycle (SDLC): Various phases of Development: Analysis, Design, Development, Implementation, and Maintenance, Systems documentation considerations: Principles of systems documentation, Types of documentation and their importance, Enforcing documentation discipline in an organization.		
Mapping of Course Outcomes		
Unit III	**System Planning**	**(08 Hours)**
Data and fact gathering techniques: Interviews, Group communication, Presentations, Site visits. Feasibility study and its importance Types of feasibility reports System Selection plan and proposal Prototyping Cost-Benefit and analysis: Tools and techniques		
Mapping of Course Outcomes		
Unit IV	**Systems Design and modeling**	**(06 Hours)**

Process modeling, Logical and physical design, Design representation, Systems flowcharts and structured charts, Data flow diagrams, Common diagramming conventions and guidelines using DFD and ERD diagrams. Data Modeling and systems analysis, Designing the internals: Program and Process design, Designing Distributed Systems.

Mapping of Course Outcomes	

Unit V	**Modular and structured design & Object Oriented Analysis**	**(08 Hours)**

Classification of forms: Input/output forms design, User-interface design, Graphical interfaces Module specifications ,Module coupling and cohesion , Top-down and bottom-up design Introduction to Object Oriented Analysis and design life cycle, object modeling: Class Diagrams, Dynamic modeling: state diagram, Dynamic modeling: sequence diagramming

Mapping of Course Outcomes	

Unit VI	**System Implementation and Maintenance & Security**	**(08 Hours)**

Planning considerations, Conversion methods, producers and controls, System acceptance Criteria, System evaluation and performance, Testing and validation, Systems qualify Control and assurance, Maintenance activities and issues.

Computer system as an expensive resource: Data and Strong media Procedures and norms for utilization of computer equipment, Audit of computer system usage, Audit trails, Types of threats to computer system and control measures: Threat to computer system and control measures, Disaster recovery and contingency planning

Mapping of Course Outcomes	

Learning Resources

Text Books:

1. Alan Dix, Janet Finlay, Gregory Abowd, Russell Beale, Human Computer Interaction, 3rd Edition, Pearson Education, 2004.
2. Wilbert O. Galitz, The Essential Guide to User Interface Design, Wiley publication.
3. Alan Cooper, Robert Reimann, David Cronin, About Face3: Essentials of Interaction design, Wiley publication.
4. Jeff Johnson, Designing with the mind in mind, Morgan Kaufmann Publication.
5. Donald A. Normann, Design of everyday things, Basic Books; Reprint edition 2002.
6. Brian Fling, Mobile Design and Development, First Edition , OReilly Media Inc., 2009.

eBooks:

1. "Systems Analysis and Design" by Alan Dennis, Barbara Haley Wixom, and David Tegarden
2. "Modern Systems Analysis and Design" by Jeffrey A. Hoffer, Joey George, and Joe Valacich
3. "Object-Oriented Systems Analysis and Design Using UML" by Simon Bennett, Steve McRobb, and Ray Farmer

MOOC/ Video Lectures available at:

1. "Systems Analysis and Design" by Coursera: This course provides a comprehensive introduction to systems analysis and design principles, methodologies, and techniques.
2. "Software Engineering: Introduction to Systems Analysis and Design" by edX: Offered by the University of British Columbia, this course covers the fundamentals of systems analysis and design, including requirements engineering and system modeling.
3. "Object-Oriented Analysis and Design" by Udemy: This course focuses on object-oriented analysis and design principles using UML notation and is suitable for learners with some prior knowledge of software development.

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CO2	1	2	-	2	-	-	-	-	-	-	-	-
CO3	2	1	2	1	-	-	-	-	-	-	-	-
CO4	1	2	-	2	-	-	-	-	-	-	-	-
CO5	-	-	2	-	-	-	-	-	-	-	-	-
CO6	-	2	1	2	-	-	-	-	-	-	-	-
CO7	1	2	2	-	-	-	-	-	-	-	-	-

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PEC-AI 501 (C): Elective 1: Pattern Recognition

Teaching Scheme	Credit Scheme	Examination Scheme and Marks
Lecture: 03 Hours/Week	**03**	**Internal Assessment (TH): 40**
		End_Semester (TH): 60

Prerequisites: Programming Foundations, Applied Statistics and Statistics for Engineers

Course Objectives:

The objective of this course is:

1. To provide a comprehensive understanding of pattern recognition techniques and algorithms.
2. To familiarize students with the concepts and principles of supervised and unsupervised learning in pattern classification.
3. To introduce students to the principles of structural pattern recognition and its applications.
4. To explore feature extraction and selection techniques for pattern recognition.
5. To expose students to recent advances in pattern recognition, including neural networks, fuzzy logic, and genetic algorithms.
6. To develop practical skills in applying pattern recognition techniques to real-world problems.

Course Outcomes:

CO1: To understand the fundamentals of pattern recognition and the concept of discriminant functions for supervised learning.
CO2: To apply clustering algorithms for unsupervised learning and classification
CO3: To comprehend the elements of formal grammars and their role in structural pattern recognition
CO4: To utilize feature extraction and selection methods
CO5: To explore recent advances in pattern recognition
CO6: To apply pattern recognition techniques to real-world problems.

Course Contents

Unit I	**Pattern Classifier**	**(08 Hours)**
Overview of pattern recognition – Discriminant functions – Supervised learning – Parametric estimation – Maximum likelihood estimation – Bayesian parameter estimation – Perceptron algorithm – LMSE algorithm – Problems with Bayes approach – Pattern classification by distance functions – Minimum distance pattern classifier.		
Mapping of Course Outcomes	CO1	
Unit II	**Unsupervised Classification**	**(08 Hours)**
Clustering for unsupervised learning and classification – Clustering concept – C-means algorithm – Hierarchical clustering procedures – Graph theoretic approach to pattern clustering – Validity of clustering solutions.		
Mapping of Course Outcomes	CO2	
Unit III	**Structural pattern recognition**	**(08 Hours)**
Elements of formal grammars – String generation as pattern description – Recognition of syntactic description – Parsing – Stochastic grammars and applications – Graph based structural representation.		
Mapping of Course Outcomes	CO3	
Unit IV	**Feature extraction and selection**	**(06 Hours)**

Entropy minimization – Karhunen – Loeve transformation – Feature selection through functions approximation – Binary feature selection.		
Mapping of Course Outcomes	CO 4	
Unit V	**Recent Advances**	**(8 Hours)**
Neural network structures for Pattern Recognition – Neural network based Pattern associators – Unsupervised learning in neural Pattern Recognition – Self-organizing networks – Fuzzy logic – Fuzzy pattern classifiers – Pattern classification using Genetic Algorithms.		
Mapping of Course Outcomes	CO5	
Unit VI	**Applications of Pattern Recognition**	**(8 Hours)**
Image and Video Recognition, Natural Language Processing, Biometric Recognition, Pattern Recognition in Medical Imaging, Pattern Recognition in Speech and Audio Processing, Pattern Recognition in Data Mining		
Mapping of Course Outcomes	CO6	

Learning Resources

Text Books:

1. Robert J.Schalkoff, Pattern Recognition Statistical, Structural and Neural Approaches, John Wiley & Sons Inc., New York, 1992.
2. J.I. Tou & R.C. Gonzalez, Pattern Recognition Priciples, Addition-Wesley.
3. R. Schalkoff, Pattern Recognition - Statistiucal, Structural and Neural Approaches, John *Wiley, 1992.*

eBooks:

1. "Pattern Recognition and Machine Learning" by Christopher M. Bishop
2. "Pattern Classification" by Richard O. Duda, Peter E. Hart, and David G. Stork
3. "Machine Learning: A Probabilistic Perspective" by Kevin P. Murphy

MOOC/ Video Lectures available at:

1. Coursera: "Pattern Recognition and Machine Learning" by Stanford University
2. edX: "Pattern Discovery in Data Mining" by University of Illinois at Urbana-Champaign
3. Udacity: "Machine Learning Engineer Nanodegree" by Udacity

The CO-PO Mapping Matrix

CO\ PO	PO 1	PO 2	PO 3	PO 4	PO 5	PO 6	PO 7	PO 8	PO 9	PO 10	PO 11	PO 12
CO1	1	1	2	1	-	-	-	-	-	-	-	-
CO2	1	2	-	2	-	-	-	-	-	-	-	-
CO3	2	1	2	1	-	-	-	-	-	-	-	-
CO4	1	2	-	2	-	-	-	-	-	-	-	-
CO5	-	-	2	-	-	-	-	-	-	-	-	-
CO6	-	2	1	2	-	-	-	-	-	-	-	-
CO7	1	2	2	-	-	-	-	-	-	-	-	-

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PEC-AI 501 (D): Elective 1: Internet of Medical Behaviour

Teaching Scheme	Credit Scheme	Examination Scheme and Marks
Lecture: 03 Hours/Week	**03**	**Internal Assessment (TH): 40**
		End_Semester (TH): 60

Prerequisites: Understanding of function systems, adequate statistics related to Machine Learning and Artificial Intelligence at the identical time and gist of sensors is additionally required in this field

Course Objectives: The objective of this course is:

1. To develop knowledge in Internet of Things (IoT) and Industrial Internet of Things (IIoT) fundamentals.
2. To gain conceptual understanding of networking and wireless communication protocols used in IIoT deployments
3. To Understand the various Internet of Things (IoT) Protocols like COAP, MQTT.etc

Course Outcomes:

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

CO 1. Develop conceptual design of Medical and Industrial IoT architecture.
CO 2. Apply sensors and various protocols for industry standard solutions
CO 3. Articulate privacy and security measures for industry standard solutions.
CO 4. Study about Internet of Medical Things (IoMT) and its applications in Healthcare industry.
CO 5 Design various applications using IoT in Healthcare Technologies.
CO 6. Demonstrate and build the project successfully by hardware/sensor requirements, coding, emulating and testing.

Course Contents

Unit I	**Introduction**	**(04 Hours)**
Introduction to IOT, What is IIOT? IOT Vs. IIOT, History of IIOT, Components of IIOT - Sensors, Interface, Networks, Key terms – IOT Platform, Interfaces, API, clouds, Data Management Analytics, Mining &Manipulation; Role of IIOT in Manufacturing Processes Use of IIOT in plant maintenance practices, Sustainability through Business excellence tools Challenges & Benefits in implementing IIOT		
Mapping of Course Outcomes	CO1	
Unit II	**IoT Architecture**	**(04 Hours)**
IOT components ;Various Architectures of IOT and IIOT, Advantages & disadvantages, Industrial Internet - Reference Architecture; IIOT System components: Sensors, Gateways, Routers, Modem, Cloud brokers, servers and its integration, WSN, WSN network design for IOT		
Mapping of Course Outcomes	CO2	
Unit III	**Sensors and Protocols**	**(05 Hours)**
Introduction to sensors, Roles of sensors in IIOT, Various types of sensors, Design of sensors, sensor architecture, special requirements for IIOT sensors, Role of actuators, types of actuators. Need of protocols; Types of Protocols, Wi-Fi, Wi-Fi direct, Zigbee, Z wave, Bacnet, BLE, Modbus, SPI , I2C, IIOT protocols – COAP, MQTT, 6lowpan, lwm2m, AMPQ. Hardwire the sensors with different protocols such as HART, MODBUS-Serial & Parallel, Ethernet, BACNet.		
Mapping of Course Outcomes	CO3	
Unit IV	**Privacy and Security**	**(05 Hours)**
Introduction to web security, Conventional web technology and relationship with IIOT, Vulnerabilities of IoT, Privacy, Security requirements, Threat analysis, Trust, IoT security tomography and layered attacker model, Identity establishment, Access control, Message integrity, Non-repudiation and availability		

Mapping of Course Outcomes	CO4

Unit V	**IoMT Introduction & Healthcare Technologies**	**(03 Hours)**
What are IoMT and its working? Tracking assets and resources, Internet of things in hospitals, collection and integration of clinical data, Major benefits of IoT in healthcare, Disadvantages of IoT in healthcare. Home Monitoring System for Aged Care, Smart Medicinal Packages for Medication Adherence, Smart Drug Delivery System for Automated Drug Dispensation, Connected Rural Healthcare Consultation, Population and Environment Monitoring of Infectious Diseases		

Mapping of Course Outcomes	CO5

Unit VI	**Application Design & Case Study**	**(03Hours)**
Application Design & Case Study: Wireless Patient Monitor system, Wearable Fitness & Activity Monitor Application Design: Design of IOT based pulse oximeter, Reliability of IoT-Aware BPNM Healthcare process.		

Mapping of Course Outcomes	CO6

Learning Resources

Text Books:

1. Alessandro Bassi, Martin Bauer, Martin Fiedler, Thorsten Kramp, Rob van Kranenburg, Sebastian Lange and Stefan Meissner, Enabling things to talk –Designing IoT solutions with the IoT.
2. Architecture Reference Model, 1 st edition ,Springer Open, 2016 Matin, Mohammad Abdul, ed. Towards Cognitive IoT Networks, 1 st edition ,Springer International Publishing, 2020.

@The CO-PO Mapping Matrix

CO\ PO	PO 1	PO 2	PO 3	PO 4	PO 5	PO 6	PO 7	PO 8	PO 9	PO 10	PO 11	PO 12
CO1	1	1	2	1	-	-	-	-	-	-	-	-
CO2	1	2	-	2	-	-	-	-	-	-	-	-
CO3	2	1	2	1	-	-	-	-	-	-	-	-
CO4	1	2	-	2	-	-	-	-	-	-	-	-
CO5	-	-	2	-	-	-	-	-	-	-	-	-
CO6	-	2	1	2	-	-	-	-	-	-	-	-
CO7	1	2	2	-	-	-	-	-	-	-	-	-

SEMESTER - VI

SEMESTER VI						
Course Code	**Course Name**	**L**	**T**	**P**	**Hr**	**Cr**
PCC-AI 601	Advanced Databases	3	0	2	5	4
PCC-AI 602	Deep Learning	3	0	2	5	4
PCC-AI 603	Machine Learning & Network Security	3	0	2	5	4
PCC-AI 604	Information Retrieval	2	0	0	2	2
PEC-AI 601	Elective II	3	0	0	3	3
PEC-AI 601	Skill Enhancement Course-II/ Internship	3	0	0	3	3
Total		**17**	**0**	**6**	**23**	**20**

Elective II (A-Software architecture, B-Quantum AI, C-Robotics and Automation, D-Cognitive Computing)

Skill Enhancement Course II Language-II: (Foreign Language (French/German/Japanese)/ Hindi/Marathi)/ Internship of 1 month.

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PCC-AI 601: Advanced Databases

Teaching Scheme	Credit Scheme	Examination Scheme and Marks
Lecture: 03 Hours/Week	**04**	**Internal Assessment (TH): 40**
		End_Semester (TH): 60

Prerequisites: Students must have fundamental knowledge of data structures & SQL queries

Course Objectives:

1. To understand fundamental structure of various databases.
2. To understand various types of databases.
3. To understand parallel and distributed Databases
4. To provide the practical knowledge in handling and analyzing real world applications in databases.

Course Outcomes:

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

CO 1. Assess various storage and retrieval methods through appropriate indexing
CO 2. Design and analyze efficiency of algorithms for database operations
CO 3. Comprehend contemporary database architectures and its relevant issues
CO 4. Evaluate different data storage techniques and select appropriate indexing structures for efficient retrieval.
CO 5. Develop optimized query execution plans and apply query optimization techniques
CO 6. Demonstrate understanding of advanced database concepts

Course Contents

Unit I	**Data storage**	**(05 Hours)**
Overview of RDBMS concepts, Basic File Structures, File Organization & Record formats, Heap sorted & Hashed Files, Buffer management, Disk Storage, Parallel Disk access with RAID, Modern Storage Architectures		
Mapping of Course Outcomes	CO1	
Unit II	**Indexing Structures**	**(08 Hours)**
Single level and Multilevel Indexes, B Tree and B+ Tree Indexes, Hash and bitmap-based indexing, Index Structures for Single Dimensional and Multidimensional Databases		
Mapping of Course Outcomes	CO2	
Unit III	**Query Processing**	**(09 Hours)**
Query Execution, Algebra for Queries, Physical-Query-Plan-Operators, Algorithms for Database Operations, Algorithms for Joins and Sorting, hash and index based algorithms, Buffer Management, Parallel Algorithms for Relational Operators		
Mapping of Course Outcomes	CO3	
Unit IV	**Query Optimization**	**(08 Hours)**
Algebraic Foundation for Improving Query Plans, Estimating Cost of Operations, Cost Based Plan Selection, Choosing Order of Joins, Optimization of Queries for Parallel, Distributed, Multidimensional and Text Database		

Mapping of Course Outcomes	CO4	
Unit V	**Transactions, Concurrency control and Recovery**	**(07Hours)**
Transaction scheduling, serializability, Coping with System Failure, Concurrency Control techniques with locking, timestamp ordering and multiversion, Redo and Undo log based recovery, recovery in multi database systems		
Mapping of Course Outcomes	CO5	
Unit VI	**Advances in database systems**	**(08 Hours)**
Distributed database systems, fragmentation, replication and allocation techniques, NoSQL based systems: key-value based, document based, column based and Graph databases, Streaming SQL, Introduction to active, temporal, spatial, multimedia and deductive databases.		
Mapping of Course Outcomes	CO6	

List of Practicals

1. Data Definition Language Commands
2. Data Manipulation Language Commands
3. Data Control Language, Transfer Control Language Commands
4. In Built Functions
5. Nested Queries And Join Queries
6. Set operators
7. Views
8. Control Structure
9. Procedure and Function
10. Trigger

Learning Resources

Text Books:

1. RamezElmasri, Shamkant B Navathe, Fundamentals of Database System, Pearson Education
2. Garcia Molina, Ullman, Widom, Data Base System Implementation, Pearson education
3. Raghu Ramakrishnan& Johannes Gehrke, Database Management Systems, McGraw Hill
4. Silberschatz, Korth, Sudarshan, Database System Concepts, McGraw Hill
5. M.TamerOzsu, Patrick Valduriez, S.Sridhar, Principles of Distributed Database Systems, Pearson Education

eBooks:

1. "Database Management Systems" by Raghu Ramakrishnan and Johannes Gehrke
2. "Database System Concepts" by Abraham Silberschatz, Henry F. Korth, and S. Sudarshan
3. "Modern Database Management" by Jeffrey A. Hoffer, Ramesh Venkataraman, and Heikki Topi

MOOC/ Video Lectures available at:

1. "Introduction to Databases" by Stanford Online (Coursera)
2. "Database Management Essentials" by University of Colorado System (Coursera)
3. "Database Systems Concepts and Design" by Georgia Institute of Technology (edX)

@The CO-PO Mapping Matrix

CO\ PO	PO 1	PO 2	PO 3	PO 4	PO 5	PO 6	PO 7	PO 8	PO 9	PO 10	PO 11	PO 12
CO1	1	1	2	1	-	-	-	-	-	-	-	-
CO2	1	2	-	2	-	-	-	-	-	-	-	-
CO3	2	1	2	1	-	-	-	-	-	-	-	-
CO4	1	2	-	2	-	-	-	-	-	-	-	-
CO5	-	-	2	-	-	-	-	-	-	-	-	-
CO6	-	2	1	2	-	-	-	-	-	-	-	-
CO7	1	2	2	-	-	-	-	-	-	-	-	-

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PCC-AI 602: Deep Learning

Teaching Scheme	Credit Scheme	Examination Scheme and Marks
Lecture: 03 Hours/Week	**04**	**Internal Assessment (TH): 40**
		End _Semester (TH): 60

Prerequisites: Students must have knowledge of linear algebra, calculus, programming skills, probability, and Statistics. Students also must have fundamental knowledge of Machine Learning.

Course Objectives:

1. To understand the theoretical foundations, algorithms and methodologies of Neural Network
2. To design and develop an application using specific deep learning models.
3. To provide the practical knowledge in handling and analyzing real world applications.

Course Outcomes:

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

CO 1. To recognize the characteristics of deep learning models that are useful to solve real-world problems.
CO 2. To differentiate different methodologies to create application using deep nets
CO 3. To identify and apply appropriate deep learning algorithms for analyzing the data for variety of problems.
CO 4. To implement different deep learning algorithms.
CO 5. To design the test procedures to assess the efficacy of the developed model
CO 6. To apply deep learning techniques to solve real-world problems in various domains

Course Contents

Unit I	**Introduction**	**(03 Hours)**
Biological Neuron, Idea of computational units, McCulloch–Pitts unit and Thresholding logic, Linear Perceptron, Perceptron Learning Algorithm, Linear separability. Convergence theorem for Perceptron Learning Algorithm.		
Mapping of Course Outcomes	CO1	
Unit II	**Feedforward Network**	**(07 Hours)**
Multilayer Perceptron, Gradient Descent, Backpropagation, Empirical Risk Minimization, regularization, auto encoders		
Mapping of Course Outcomes	CO2	
Unit III	**Deep Neural Networks**	**(09 Hours)**
Difficulty of training deep neural networks, Greedy layerwise training. Newer optimization methods for neural networks (Adagrad, adadelta, rmsprop, adam, NAG), second order methods for training, Saddle point problem in neural networks, Regularization methods (dropout , drop connect, batch normalization).		
Mapping of Course Outcomes	CO3	
Unit IV	**Recurrent Neural Networks**	**(07 Hours)**
Back propagation through time, Long Short Term Memory, Gated Recurrent Units, Bidirectional LSTMs, Bidirectional RNNs		

Mapping of Course Outcomes	CO4	
Unit V	**Convolutional Neural Networks & Deep Generative Models**	**(09 Hours)**
Architectural Overview – Motivation - Layers – Filters –Parameter sharing – Regularization, Popular CNN Architectures: LeNet, AlexNet. Restrictive Boltzmann Machines (RBMs), Introduction to MCMC and Gibbs Sampling, gradient computations in RBMs, Deep Boltzmann Machines		
Mapping of Course Outcomes	CO5	
Unit VI	**Recent trends and Applications**	**(07 Hours)**
Variational Autoencoders, Generative Adversarial Networks, Multi-task Deep Learning, Multi-view Deep Learning. Vision, NLP, Speech.		
Mapping of Course Outcomes	CO6	

List of Practical

1. Classification with Multilayer Perceptron using Scikit-learn (MNIST Dataset)
2. Hyper-Parameter Tuning in Multilayer Perceptron
3. Deep learning Packages Basics: Tensorflow, Keras, Theano and PyTorch
4. Classification of MNIST Dataset using CNN
5. Face recognition using CNN
6. Object detection using Transfer Learning of CNN architectures
7. Recommendation system using Deep Learning
8. Dimensionality Reduction using Deep learning
9. Time Series Prediction using RNN
10. Language Modeling using RNN
11. Sentiment Analysis using LSTM
12. Image generation using GAN

Learning Resources

Text Books:

1. Neural Networks: A Systematic Introduction, Raúl Rojas, 1996
2. Ian Goodfellow, Yoshua Bengio and Aaron Courville, Deep Learning, MIT Press, 2016
3. Michael A. Nielsen, Neural Networks and Deep Learning , Determination Press, 2015
4. Yoshua Bengio, Learning Deep Architectures for AI, now Publishers Inc., 2009
5. Josh Patterson, Adam Gibson "Deep Learning: A Practitioner's Approach", O'Reilly Media, 2017.
6. Umberto Michelucci “Applied Deep Learning. A Case-based Approach to Understanding Deep Neural Networks” Apress, 2018

e-Books:

1. "Deep Learning" by Ian Goodfellow, Yoshua Bengio, and Aaron Courville
2. "Neural Networks and Deep Learning: A Textbook" by Charu C. Aggarwal
3. "Deep Learning with Python" by Francois Chollet

MOOC/ Video Lectures available at:

1. "Deep Learning Specialization" by deeplearning.ai (Coursera)
2. "Neural Networks for Machine Learning" by University of Toronto (Coursera)
3. "Deep Learning" by Stanford University (Coursera)

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CO\ PO	PO 1	PO 2	PO 3	PO 4	PO 5	PO 6	PO 7	PO 8	PO 9	PO 10	PO 11	PO 12
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CO3	2	1	2	1	-	-	-	-	-	-	-	-
CO4	1	2	-	2	-	-	-	-	-	-	-	-
CO5	-	-	2	-	-	-	-	-	-	-	-	-
CO6	-	2	1	2	-	-	-	-	-	-	-	-
CO7	1	2	2	-	-	-	-	-	-	-	-	-

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PCC-AI 603: Machine Learning & Network Security

Teaching Scheme	Credit Scheme	Examination Scheme and Marks
Lecture: 03 Hours/Week	**04**	**Internal Assessment (TH): 40**
		End _Semester (TH): 60

Prerequisites: Students also must have fundamental knowledge of Machine Learning and Computer Networks.

Course Objectives:

1. To study how machine learning can help in securing data.
2. To learn how machine learning has contributed to the success of filters
3. To understand quick way to detect anomalies
4. To conduct malware analysis by extracting used information from computer binaries
5. To examine how attackers exploit consumer-facing websites and app functionality
6. To translate your machine learning algorithms from the lab to production

Course Outcomes:

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

CO 1 Learn different machine learning algorithms to secure information
CO 2. Implement filtering methods using machine learning techniques
CO 3. Analyze different methods of detecting anomalies.
CO 4. Perform malware analysis using information
CO 5. Visualize the attacks on consumer websites
CO 6. Model machine learning based model to create a production system

Course Contents

Unit I	**Convergence of Machine Learning and Network Security**	**(06 Hours)**
Cyber Threat Landscape,The Cyber Attacker's Economy, Overview of Machine Learning, Real-World Uses of Machine Learning in Security, Spam Fighting: An Iterative Approach		
Mapping of Course Outcomes	CO1	
Unit II	**Anomaly Detection**	**(07 Hours)**
Anomaly Detection Versus Supervised Learning, Intrusion Detection with Heuristics, Data-Driven Methods, Feature Engineering for Anomaly Detection, Anomaly Detection with Data and Algorithms, Challenges of Using Machine Learning in Anomaly Detection		
Mapping of Course Outcomes	CO2	
Unit III	**Malware Analysis**	**(07 Hours)**
Understanding Malware, Feature Generation, From Features to Classification, Live malware analysis, dead malware analysis, Android Malware Analysis.		
Mapping of Course Outcomes	CO3	
Unit IV	**Network Traffic Analysis**	**(07Hours)**

Theory of Network Defense, Machine Learning and Network Security, Building a Predictive Model to Classify Network Attacks		
Mapping of Course Outcomes	CO4	
Unit V	**Protecting the Consumer Web**	**(07 Hours)**
Monetizing the Consumer Web, Types of Abuse and the Data That Can Stop Them, Supervised Learning for Abuse Problems, Clustering Abuse		
Mapping of Course Outcomes	CO5	
Unit VI	**Production Systems**	**(07 Hours)**
Defining Machine Learning System Maturity and Scalability, Data Quality, Model Quality, Performance, Maintainability, Monitoring and Alerting, Security and Reliability		
Mapping of Course Outcomes	CO6	

List of Practical

1. Anomaly detection using supervised learning algorithm.
2. Study and implement intrusion detection system using SVM
3. Live malware analysis using unsupervised learning algorithm
4. Study and implement clustering abuse.

Learning Resources

Text Books:

1. Clarence Chio, David Freeman “Machine Learning and Security”, O'Reilly Media, Inc.ISBN: 9781491979907
2. SumeetDua, Xian Du. “Data Mining and Machine Learning in Cybersecurity”, CRC Press, ISBN:978-1439839423
3. Learning Nessus for Penetration Testing, by Himanshu Kumar
4. The Web Application Hacker's Handbook: Finding and Exploiting Security Flaws, 2ed
5. Mastering Modern Web Penetration Testing by Prakhar Prasad

e-Books:

1. "Network Security: Private Communication in a Public World" by Charlie Kaufman, Radia Perlman, and Mike Speciner
2. "Practical Packet Analysis: Using Wireshark to Solve Real-World Network Problems" by Chris Sanders
3. "Network Security Essentials: Applications and Standards" by William Stallings

Home

MOOC/ Video Lectures available at:

1. "Machine Learning" by Stanford University on Coursera
2. "Deep Learning Specialization" by deeplearning.ai on Coursera
3. "Machine Learning with Python" by IBM on Coursera

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CO2	1	2	-	2	-	-	-	-	-	-	-	-
CO3	2	1	2	1	-	-	-	-	-	-	-	-
CO4	1	2	-	2	-	-	-	-	-	-	-	-
CO5	-	-	2	-	-	-	-	-	-	-	-	-
CO6	-	2	1	2	-	-	-	-	-	-	-	-
CO7	1	2	2	-	-	-	-	-	-	-	-	-

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PCC-AI 604: Information Retrieval

Teaching Scheme	Credit Scheme	Examination Scheme and Marks
Lecture: 02 Hours/Week	**02**	**Internal Assessment (TH): 20**
		End_Semester (TH): 30

Prerequisites: Students must have the minimal concept of Data Base Management Systems.

Course Objectives:

1. To enable students to understand the various aspects of an Information retrieval system and its evaluation and to be able to design
2. To understand the fundamental techniques for hypermedia architectures, design and usability, document management and retrieval, metadata management, and searching the web.
3. To analyse ranked retrieval of a very large number of documents with hyperlinks between them.

Course Outcomes:

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

CO 1. To apply IR principles to locate relevant information large collections of data.
CO 2. To design different document clustering algorithms
CO 3. To implement retrieval systems for web search tasks.
CO 4. To design an Information Retrieval System for web search tasks.
CO 5. To analyze and address ethical considerations and challenges
CO 6. To explore and understand the impact of information retrieval systems on society

Course Contents

Unit I	**Introduction and Basic IR Models**	**(04 Hours)**
Goals and history of IR. The impact of the web on IR. Boolean and vector-space retrieval models; ranked retrieval; text-similarity metrics; TF-IDF (term frequency/inverse document frequency) weighting; cosine similarity.		
Mapping of Course Outcomes	CO1	
Unit II	**Vector-Space Retrieval & Experimental Evaluation**	**(05 Hours)**
Simple tokenizing, stop-word removal, and stemming; inverted indices; efficient processing with sparse vectors Performance metrics: recall, precision, F-measure, and NDCG; Evaluations on benchmark text collections		
Mapping of Course Outcomes	CO2	
Unit III	**Query Expansion & Text Representation**	**(05 Hours)**
Relevance feedback; Query expansion. Word statistics; Zipf's law; Porter stemmer; morphology; index term selection; using thesauri.		
Mapping of Course Outcomes	CO3	
Unit IV	**Web Search**	**(02 Hours)**

Search engines; spidering; metacrawlers; directed spidering; link analysis (e.g. hubs and authorities, Google PageRank); shopping agents.		
Mapping of Course Outcomes	CO4	
Unit V	**Text Categorization & Text Clustering**	**(06 Hours)**
Categorization algorithms: Rocchio, nearest neighbor, and naive Bayes. Applications to information filtering and organization. Clustering algorithms: agglomerative clustering; k-means; expectation maximization (EM). Applications to web search and information organization		
Mapping of Course Outcomes	CO5	
Unit VI	**Language-Model Based Retrieval & Recommender Systems**	**(05 Hours)**
Using naive Bayes text classification for ad hoc retrieval. Improved smoothing for document retrieval. Collaborative filtering and content-based recommendation of documents and products. Privacy, Fairness, Fake news and disinformation, Filter bubble, Viewpoint diversity, Fostering extremism, Internet addiction.		
Mapping of Course Outcomes	CO6	

Text Books:

1. Information Storage and Retrieval Systems – Theory and Implementation, Second Edition, Gerald J. Kowalski, Mark T. Maybury, Springer
2. Christopher D. Manning, Prabhakar Raghavan and Hinrich Schütze, Introduction to Information Retrieval, Cambridge University Press. 2008. http://nlp.stanford.edu/IR-book/information-retrieval-book.html Ian Goodfellow, Yoshua Bengio and Aaron Courville, Deep Learning, MIT Press, 2016
3. ChengXiang Zhai, Statistical Language Models for Information Retrieval (Synthesis Lectures Series on Human Language Technologies), Morgan & Claypool Publishers, 2008. Yoshua Bengio, Learning Deep Architectures for AI, now Publishers Inc., 2009
4. Frakes, W.B., Ricardo Baeza-Yates: Information Retrieval Data Structures and Algorithms, Prentice Hall, 1992..
5. Information Storage & Retrieval By Robert Korfhage – John Wiley & Sons.
6. Modern Information Retrieval By Yates and Neto Pearson Education.

eBooks:

1. "Introduction to Information Retrieval" by Christopher D. Manning, Prabhakar Raghavan, and Hinrich Schütze
2. "Modern Information Retrieval: The Concepts and Technology behind Search" by Ricardo Baeza-Yates and Berthier Ribeiro-Neto

MOOC/ Video Lectures available at:

1. "Information Retrieval (IR): Representation and Retrieval of Textual Information" by University of Illinois at Urbana-Champaign (Coursera)
2. "Introduction to Information Retrieval" by Stanford University (edX)

@The CO-PO Mapping Matrix

CO\ PO	PO 1	PO 2	PO 3	PO 4	PO 5	PO 6	PO 7	PO 8	PO 9	PO 10	PO 11	PO 12
CO1	1	1	2	1	-	-	-	-	-	-	-	-
CO2	1	2	-	2	-	-	-	-	-	-	-	-
CO3	2	1	2	1	-	-	-	-	-	-	-	-
CO4	1	2	-	2	-	-	-	-	-	-	-	-
CO5	-	-	2	-	-	-	-	-	-	-	-	-
CO6	-	2	1	2	-	-	-	-	-	-	-	-
CO7	1	2	2	-	-	-	-	-	-	-	-	-

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PEC-AI 601 (A): Elective-II Software Architecture

Teaching Scheme	Credit Scheme	Examination Scheme and Marks
Lecture: 03 Hours/Week	**03**	**Internal Assessment (TH): 40**
		End_Semester (TH): 60

Prerequisites: Programming Language, UML: Architecture of the building,

Course Objectives:

The objective of this course is:

1. To understand the need, design approaches for software architecture to bridge the dynamic requirements and implementation.
2. To learn the design principles and to apply for large scale systems
3. To design architectures for distributed heterogeneous systems, environment through brokerage interaction

Course Outcomes:

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

CO 1. To understand the need of software architecture for sustainable dynamic systems.
CO 2. To apply design principles and to apply for large scale systems
CO 3. To design architectures for distributed heterogeneous systems
CO 4. To use service oriented and model driven architectures and the aspect oriented architecture.
CO 5. To develop appropriate architectures through various case studies.
CO6. To understand the concepts of Model-Driven Architecture (MDA) and Cloud Computing

Course Contents

Unit I	**Introduction to software architecture**	**(08 Hours)**
Bridging Requirements and Implementation, Design Guidelines, Software Quality attributes. Software Architecture Design Space. Agile Approach to Software Architecture Design, Models for Software Architecture Description Languages (ADL).		
Mapping of Course Outcomes	CO1	
Unit II	**Object-oriented paradigm**	**(08 Hours)**
Design Principles. Data-Centered Software Architecture: Repository Architecture, Blackboard Architecture. Hierarchical Architecture Main-Subroutine, Master-Slave, Layered, Virtual Machine. Interaction-Oriented Software Architectures: Model-View-Controller (MVC), Presentation-Abstraction-Control (PAC).		
Mapping of Course Outcomes	CO2	
Unit III	**Distributed Architecture**	**(08 Hours)**
Client-Server, Middleware, Multi-tiers, Broker Architecture – MOM,CORBA Message Broker Architecture-Service-Oriented Architecture (SOA), SOAP, UDDI, SOA Implementation in Web Services, Grid/cloud Service Computing. Heterogeneous Architecture- Methodology of Architecture Decision, Quality Attributes.		
Mapping of Course Outcomes	CO3	

Unit IV	Architecture of user interfaces containers	(10 Hours)
Case study-web service. Product Line Architectures methodologies, processes and tools. Software Reuse and Product Lines -Product Line Analysis, Design and implementation, configuration Models. Model Driven Architectures (MDA) –why MDA- Model transformation and software architecture, SOA and MDA. Eclipse modeling framework.		
Mapping of Course Outcomes	CO4	
Unit V	**Aspect Oriented Architectures**	**(06 Hours)**
AOP in UML,AOP tools, Architectural aspects and middleware Selection of Architectures, Evaluation of Architecture Designs, Case Study: Online Computer Vendor, order processing, manufacture &shipping – inventory, supply chain cloud service Management, semantic web services		
Mapping of Course Outcomes	CO5	
Unit VI	**Model-Driven Architectures and Cloud Computing**	**(08 Hours)**
Introduction to Model-Driven Architecture (MDA), MDA components and processes, Model transformation in MDA, Cloud Computing concepts, Cloud service models (SaaS, PaaS, IaaS), Cloud deployment models (Public, Private, Hybrid), Architectural considerations for Cloud Computing.		
Mapping of Course Outcomes	CO6	

Text Books:

1. Len Bass, Paul Clements, and Rick Kazman, “Software Architectures Principles and Practices”, 2nd Edition, Addison-Wesley, 2003.
2. Anthony J Lattanze, “Architecting Software Intensive System. A Practitioner’s Guide”, Auerbach Publications, 2010.

eBooks:

"Software Architecture in Practice" by Len Bass, Paul Clements, and Rick Kazman. This book provides a comprehensive guide to software architecture principles and practices.

MOOC/ Video Lectures available at:

"Architecting Software on AWS" by Amazon Web Services (AWS) on Coursera.

The CO-PO Mapping Matrix

CO\ PO	PO 1	PO 2	PO 3	PO 4	PO 5	PO 6	PO 7	PO 8	PO 9	PO 10	PO 11	PO 12
CO1	1	1	2	1	-	-	-	-	-	-	-	-
CO2	1	2	-	2	-	-	-	-	-	-	-	-
CO3	2	1	2	1	-	-	-	-	-	-	-	-
CO4	1	2	-	2	-	-	-	-	-	-	-	-
CO5	-	-	2	-	-	-	-	-	-	-	-	-
CO6	-	2	1	2	-	-	-	-	-	-	-	-
CO7	1	2	2	-	-	-	-	-	-	-	-	-

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PEC-AI 601 (B): Elective-II Quantum AI

Teaching Scheme	Credit Scheme	Examination Scheme and Marks
Lecture: 03 Hours/Week	**03**	**Internal Assessment (TH): 40**
		End_Semester (TH): 60

Prerequisites: Data Structure and Algorithm, Programming in Python/C

Course Objectives: The objective of this course is:

1. To impart necessary knowledge to the learner so that he/she can develop and implement algorithm and write programs using these algorithm.

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

CO 1. To interpret working of a Quantum Computing program, its architecture and program model
CO 2. To develop quantum logic gate circuits
CO 3. To develop quantum algorithm
CO 4. To implement quantum algorithm on major toolkits ions
CO 5. To apply quantum computing principles and algorithms to solve machine learning problems.
CO 6. To understand the applications and limitations of quantum machine learning techniques.

Course Contents

Unit I	**Fundamental Concepts**	**(08 Hours)**
Global Perspectives – Quantum Bits – Quantum Computation – Quantum Algorithms -Experimental Quantum Information Processing – Quantum Information.		
Mapping of Course Outcomes	CO1	
Unit II	**Feature Identification**	**(08 Hours)**
Feature identification, selection and extraction. Distance measures, clustering transformation and feature ordering, clustering in feature selection, feature selection through maximization and approximations.		
Mapping of Course Outcomes	CO2	
Unit III	**Classification**	**(08 Hours)**
Pattern classification by distance functions. Clusters and cluster seeking algorithms. Pattern classification by likelihood functions. Baye's classifier and performance measures.		
Mapping of Course Outcomes	CO3	
Unit IV	**Neural Network**	**(10 Hours)**
Artificial neural network model, Neural network-based pattern associators, Feed forward networks and training by back-propagation- ART networks.		
Mapping of Course Outcomes	CO4	
Unit V	**Applications**	**(06 Hours)**

Applications of statistical and neural network – based pattern classifiers in speech recognition, image recognition and target recognition.		
Mapping of Course Outcomes	CO5	
Unit VI	**Quantum Machine Learning**	**(08 Hours)**
Introduction to Quantum Machine Learning, Quantum Neural Networks, Quantum Support Vector Machines, Quantum k-means Clustering, Quantum Dimensionality Reduction, Quantum Generative Models.		
Mapping of Course Outcomes	CO6	

Learning Resources

Text Books:

1. Michael A. Nielsen, Issac L. Chuang, "Quantum Computation and Quantum Information", Tenth Edition, Cambridge University Press, 2010.

eBooks:

"Quantum Machine Learning: What Quantum Computing Means to Data Mining" by Peter Wittek. This book provides a comprehensive overview of quantum machine learning algorithms and their applications.

MOOC/ Video Lectures available at:

"Quantum Computing for Everyone" by The University of Chicago on Coursera. This course offers a beginner-friendly introduction to quantum computing, covering fundamental concepts and applications.

The CO-PO Mapping Matrix

CO\ PO	PO 1	PO 2	PO 3	PO 4	PO 5	PO 6	PO 7	PO 8	PO 9	PO 10	PO 11	PO 12
CO 1	1	1	2	1	-	-	-	-	-	-	-	-
CO 2	1	2	-	2	-	-	-	-	-	-	-	-
CO 3	2	1	2	1	-	-	-	-	-	-	-	-
CO 4	1	2	-	2	-	-	-	-	-	-	-	-
CO 5	-	-	2	-	-	-	-	-	-	-	-	-
CO 6	-	2	1	2	-	-	-	-	-	-	-	-
CO 7	1	2	2	-	-	-	-	-	-	-	-	-

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PEC-AI 601 (C): Elective-II Robotics and Automation

Teaching Scheme	Credit Scheme	Examination Scheme and Marks
Lecture: 03 Hours/Week	**03**	**Internal Assessment (TH): 40**
		End_Semester (TH): 60

Prerequisites: MATLAB

Course Objectives:

The objective of this course is:

1. To introduce different types of robotics and demonstrate them to identify different parts and components.
2. To write programming for simple operations.

Course Outcomes:

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

CO 1. To explain the fundamental concepts of robotics
CO 2. To apply mathematical representations and transformations
CO 3. To analyze the differential motion and statics of manipulators using velocity and Jacobian matrices.
CO 4. To implement path planning techniques for robot motion in joint space and Cartesian space.
CO 5. To understand the dynamics of robotic manipulators and apply control schemes for manipulator motion.
CO 6. To apply force control methods for robotic manipulators and understand the challenges involved.

Course Contents

Unit I	**Basic concepts**	**(08 Hours)**
Brief history-Types of Robot–Technology-Robot classifications and specifications-Design and control issues-Various manipulators – Sensors - work cell - Programming languages.		
Mapping of Course Outcomes	CO1	
Unit II	**Direct and inverse kinematics**	**(08 Hours)**
Mathematical representation of Robots - Position and orientation – Homogeneous transformation- Various joints- Representation using the Denavit Hattenberg parameters -Degrees of freedom-Direct kinematics-Inverse kinematics- SCARA robots- Solvability – Solution methods-Closed form solution.		
Mapping of Course Outcomes	CO2	
Unit III	**Manipulator differential motion and statics**	**(08 Hours)**
Linear and angular velocities-Manipulator Jacobian-Prismatic and rotary joints–Inverse -Wrist and arm singularity - Static analysis - Force and moment Balance.		
Mapping of Course Outcomes	CO3	
Unit IV	**Path planning**	**(08 Hours)**
Definition-Joint space technique-Use of p-degree polynomial-Cubic polynomial-Cartesian space technique - Parametric descriptions - Straight line and circular paths - Position and orientation planning.		
Mapping of Course Outcomes	CO4	
Unit V	**Dynamics and control**	**(08 Hours)**

Lagrangian mechanics-2DOF Manipulator-Lagrange Euler formulation-Dynamic model – Manipulator control problem-Linear control schemes-PID control scheme-Force control of robotic manipulator.		
Mapping of Course Outcomes	CO5	
Unit VI	**Sensor Integration and Robot Perception**	**(10 Hours)**
Robot sensing and perception, Types of sensors (e.g., vision, force/torque, proximity), Sensor fusion techniques, Object recognition and tracking, Robot localization and mapping.		
Mapping of Course Outcomes	CO 6	

Learning Resources

eBooks:

"Introduction to Robotics: Mechanics and Control" by John J. Craig. This book provides a comprehensive introduction to robotics, covering fundamental concepts, kinematics, dynamics, control, and applications.

MOOC/ Video Lectures available at:

"Modern Robotics: Mechanics, Planning, and Control" by Northwestern University on Coursera. This course covers topics such as robot kinematics, dynamics, motion planning, and control, providing a hands-on approach to learning robotics.

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PEC-AI 601 (D): Elective-II Cognitive computing

Teaching Scheme	Credit Scheme	Examination Scheme and Marks
Lecture: 03 Hours/Wee	**03**	**Internal Assessment (TH): 40**
		End_Semester (TH): 60

Prerequisites: Machine Learning and Artificial Intelligence

Course Objectives: The objective of this course is:

1. Use the Innovation Canvas to justify potentially successful products.
2. Explain various ways in which to develop a product idea.

Course Outcomes:

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

CO 1. To understand the foundation and principles of cognitive computing and its applications.
CO 2. To apply design principles to build cognitive systems and leverage machine learning for hypotheses generation and scoring.
CO 3. To utilize natural language processing (NLP) techniques to support cognitive systems and solve business problems.
CO 4. To effectively represent knowledge using taxonomies and ontologies in cognitive systems.
CO 5. To explore the relationship between big data and cognitive computing, and integrate big data with traditional data sources.
CO 6. To apply advanced analytics techniques to cognitive computing and leverage open-source tools for creating value.

Course Contents

Unit I	**Foundation of Cognitive Computing**	**(07 Hours)**
cognitive computing as a new generation, the uses of cognitive systems, system cognitive, gaining insights from data, Artificial Intelligence as the foundation of cognitive computing, understanding cognition		
Mapping of Course Outcomes	CO1	
Unit II	**Design Principles for Cognitive Systems**	**(06 Hours)**

Components of a cognitive system, building the corpus, bringing data into cognitive system, machine learning, hypotheses generation and scoring, presentation and visualization services		
Mapping of Course Outcomes	CO2	
Unit III	**Natural Language Processing in support of a Cognitive System**	**(06 Hours)**
Role of NLP in a cognitive system, semantic web, Applying Natural language technologies to Business problems Representing		
Mapping of Course Outcomes	CO3	
Unit IV	**knowledge in Taxonomies and Ontologies**	**(07 Hours)**
Representing knowledge, Defining Taxonomies and Ontologies, knowledge representation, models for knowledge representation, implementation considerations		
Mapping of Course Outcomes	CO4	
Unit V	**Relationship between Big Data and Cognitive Computing**	**(07 Hours)**
Dealing with human-generated data, defining big data, architectural foundation, analytical data warehouses, Hadoop, data in motion and streaming data, integration of big data with traditional data		
Mapping of Course Outcomes	CO5	
Unit VI	**Applying Advanced Analytics to cognitive computing**	**(06 Hours)**
Advanced analytics is on a path to cognitive computing, Key capabilities in advanced analytics, Using advanced analytics to create value, Impact of open source tools on advanced		
Mapping of Course Outcomes	CO6	

Learning Resources

Text Books:

1. Judith H Hurwitz, Marcia Kaufman, Adrian Bowles , “Cognitive computing and Big Data Analytics” , Wiley

eBooks:

"Cognitive Computing: A Brief Guide for Game Changers" by Peter Fingar. This book provides an overview of cognitive computing and its potential applications in various industries.

MOOC/ Video Lectures available at:

"Introduction to Cognitive Computing" by IBM on Coursera. This course offers an introduction to cognitive computing, covering topics such as natural language processing, machine learning, and advanced analytics.

The CO-PO Mapping Matrix

CO\ PO	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12
CO1	1	1	2	1	-	-	-	-	-	-	-	-
CO2	1	2	-	2	-	-	-	-	-	-	-	-
CO3	2	1	2	1	-	-	-	-	-	-	-	-
CO4	1	2	-	2	-	-	-	-	-	-	-	-
CO5	-	-	2	-	-	-	-	-	-	-	-	-
CO6	-	2	1	2	-	-	-	-	-	-	-	-