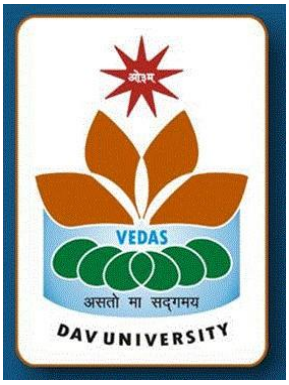
DAV University, Jalandhar

FACULTY OF SCIENCE



Course Scheme & Syllabus
For
Bachelor of Science in Computer Science
(Hons.)

(As per NEP-2020)
Batch-2024 &onwards

(As per Choice Based Credit System)
1st TO 8th SEMESTER

DAV University, Jalandhar

Introductory Note of the Programme

The BSc program is designed to equip you with the knowledge and skills necessary to thrive in the rapidly evolving field of information technology, physics and mathematics. Over the course of this program, you will explore various aspects of computer science, including programming languages, database management, software development, networking, web development, and much more. Our curriculum is carefully crafted to strike a balance between theoretical knowledge and practical application, ensuring that you not only grasp the fundamental concepts but also gain hands-on experience in solving real-world problems.

Program Educational Objectives (PEOs)

PEO-1. Work productively as successful Computer professionals in diverse career paths including supportive and leadership roles on multidisciplinary teams or be active in higher studies.

PEO-2. Communicate effectively, recognize and incorporate societal needs and constraints in their professional endeavours, and practice their profession with high regard to ethical responsibilities.

PEO-3. Engage in life-long learning and to remain current in their profession to foster personal and organizational growth.

Programme Outcomes (POs)

PO-1: Apply mathematics and computing fundamental and domain concepts to find out the solution of defined problems and requirements. (Computational Knowledge)

PO-2: Use fundamental principle of Mathematics and Computing to identify, formulate research literature for solving complex problems, reaching appropriate solutions. (Problem Analysis)

PO-3: Understand to design, analyze and develop solutions and evaluate system components or processes to meet specific need for local, regional and global public health, societal, cultural, and environmental systems. (Design/Development of Solutions)

PO-4: Use expertise research-based knowledge and methods including skills for analysis and development of information to reach valid conclusions. (Conduct Investigations of Complex Computing Problems) **PO-5:** Create, select, and apply appropriate techniques, resources, and modern engineering and IT tools including prediction and modelling to complex engineering activities with an understanding of the limitations. (Modern tool usage)

PO-6: Exhibiting ethics for regulations, responsibilities and norms in professional computing practices. (Professional Ethics)

PO-7: Understand the impact of the professional engineering solutions in societal and environmental contexts, and demonstrate the knowledge of, and need for sustainable development (Environment and sustainability).

PO-8: Apply ethical principles and commit to professional ethics and responsibilities and norms of the engineering practice (Ethics).

PO-9: Function effectively as an individual, and as a member or leader in diverse teams, and in multidisciplinary settings (Individual and team work).

PO-10: Communicate effectively on complex engineering activities with the engineering community and with society at large, such as, being able to comprehend and write effective reports and design documentation, make effective presentations, and give and receive clear instructions (Communication). **PO-11:** Demonstrate knowledge and understanding of the engineering and management principles and apply these to one's own work, as a member and leader in a team, to manage projects and in multidisciplinary environments (Project management and finance).

PO-12: Recognize the need for, and have the preparation and ability to engage in independent and life-long learning in the broadest context of technological change (Life-long learning).

Program Specific Objectives (PSOs)

PSO-1: Analyze their abilities in systematic planning, developing, testing and executing complex computing and computer science in field of Physics, Mathematics, social media and Analytics, Web Application Development and Data Interpretations.

PSO-2: Apprise in-depth expertise and sustainable learning that contributes to multi-disciplinary creativity, permutation, modernization and study to address global interest.

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Mapping of PSOs with PEOs

PEOs→ / PSO↓	PEO 1	PEO 2	PEO 3
PSO1	Yes	-------	Yes
PSO2	--------	Yes	Yes

Mapping of POs with PEOs

PEOs → / POs↓	PEO 1	PEO 2	PEO 3
PO1	Yes		Yes
PO2			Yes
PO3	Yes		Yes
PO4		Yes	
PO5	Yes	Yes	
PO6			Yes
PO7	Yes		Yes
PO8			
PO9		Yes	
PO10	Yes		Yes
PO11		Yes	
PO12	Yes	Yes	

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Scheme of Courses
Bachelor of Science (Computer Science)

Credit Details			
S.No.	**Course Category**	**Course Category Abbreviation**	**3-Yr B.C.A/… (Credits)**
1.1	Discipline Specific Courses-Core	DSC	65
1.2	Discipline Specific-Skill Enhancement Courses-Core	DS-SEC	00
1.3	Discipline Specific-Value Added Courses-Core	DS-VAC	
Total of Discipline Specific Core Courses			
2.1	Minor Courses	MC	24
OR			
2.2	Interdisciplinary Courses	IDC	00
3	Multidisciplinary Courses	MDC	11
4	Ability Enhancement Course- Common	AEC-C	08
5	Value Added Courses-Common	VAC-C	06
6.1	Skill Enhancement Courses- Common	SEC-C	08
6.2	Skill Enhancement Courses-Summer Internship	SEC-SI	04
Total of Skill Enhancement Courses			
Total Credits			**126**

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Scheme of Courses Bachelor of Science (Hons.) (Computer Science)

Credit Details				
S.No.	**Course Category**	**Course Category Abbreviation**	**4-Yr B.C.A. (Hons.)/.. (Credits)**	**4-Yr B.C.A. (Hons/.. (Hons. with Res.) (Credits)**
1.1	Discipline Specific Courses-Core	DSC	88	76
1.2	Discipline Specific-Skill Enhancement Courses-Core	DS-SEC	04	04
1.3	Discipline Specific-Value Added Courses-Core	DS-VAC		
	Total of Discipline Specific Core Courses			
2.1	Minor Courses	MC	32	32
OR				
2.2	Interdisciplinary Courses	IDC	00	00
3	Multidisciplinary Courses	MDC	11	11
4	Ability Enhancement Course-Common	AEC-C	08	08
5	Value Added Courses-Common	VAC-C	06	06
6.1	Skill Enhancement Courses-Common	SEC-C	08	08
6.2	Skill Enhancement CoursesSummer Internship	SEC-SI	04	04
6.3	Skill Enhancement Courses-Research Project/Dissertation	SEC-RP	--	12
Total of Skill Enhancement Courses				
Total Credits			**161**	**160**

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Semester 1

S. No	Paper Code	Course Title	Course Category	L	T	P	Cr
1	CSP103	Algorithm Design and Programming Using C	DSC	3	0	2	4
2	MAT171	Algebra	DSC	3	0	0	3
3	PHS101	Mechanics	DSC	3	0	2	4
4	XXXX	Multi-Disciplinary Course	MDC	3	0	0	3
5	XXXX	Ability-Enhancement Course	AEC-C	2	0	0	2
6	XXXX	Skill-Enhancement Course (common)	SEC-C	2	0	0	2
7	XXXX	Value-added Course	VAC-C	2	0	0	2
	Total						**20**

L- Lectures T- Tutorial P- Practical Cr.- Credits

Semester 2

S. No	Paper Code	Course Title	Course Category	L	T	P	Cr
1	CSP104	Object Oriented Programming using C++	DSC	3	0	2	4
2	MAT172	Ordinary Differential Equations	DSC	3	0	0	3
3	PHS201	Vibrations and Waves	DSC	3	0	2	4
4	XXXX	Multi -Disciplinary Course	MDC	2	0	0	2
5	XXXX	Ability-Enhancement Course	AEC-C	2	0	0	2
6	XXXX	Skill-Enhancement Course (common)	SEC-C	3	0	0	3
7	XXXX	Value-added Course	VAC-C	1	0	2	2
8	XXXX	Value-added Course	VAC-C	1	1	0	2
	Total						**22**

L- Lectures T- Tutorial P- Practical Cr.- Credits

FIRST EXIT:

The students will be awarded "Undergraduate Certificate in Computer Science" after exit at this point, provided they secure 4 Credits in skill/work-based vocational courses or internship/apprenticeship for 4-6 weeks (with minimum 120 hours) during summer term.

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Semester 3

S.No	Paper Code	Course Title	Course Category	L	T	P	Cr
1	CSP 203	Database Concepts	DSC	3	0	2	4
2	MAT 271	Real Analysis	DSC	3	0	0	3
3	PHS202	Digital Systems and Application	MC	3	0	2	4
4	XXXX	Multi -Disciplinary Course	MDC	3	0	0	3
5	XXXXX	Ability-Enhancement Course	AEC-C	2	0	0	2
6	XXXX	Skill-Enhancement Course (common)	SEC-C	3	0	0	3
	Total						**19**

L- Lectures T- Tutorial P- Practical Cr.- Credits

Semester 4

S. No	Paper Code	Course Title	Course Category	L	T	P	Cr
1	CSP 206	Operating Systems	DSC	3	0	0	3
2	CSP 204	Data Structures	DSC	3	0	2	4
3	CSP 208	Computer Networks	DSC	3	0	2	4
4	MAT272	Analytical Geometry	MC	3	0	0	3
5	PHS211	Optics	MDC	3	0	0	3
6	PHS204	Thermal and Statistical Physics	MC	3	0	2	4
7	XXXX	Ability-Enhancement Course	AEC-C	2	0	0	2
	Total						**21**

L- Lectures T- Tutorial P- Practical Cr.- Credits

SECOND EXIT:

The student will be awarded "Undergraduate Diploma in Computer Science" after exit at this point provided that he/she secure 4 Credits in skill/work based vocational courses or internship/apprenticeship for 4 – 6 weeks (with minimum 120 hours) offered during first year summer term or second year summer term.

NCC 3 credits are only earned by those students who are opted NCC

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Semester 5

S. No	Paper Code	Course Title	Course Category	L	T	P	Cr
1	CSP 302	Programming in Python	DSC	3	0	2	4
2	CSP 304	Cyber Security	DSC	3	0	2	4
3	MTH	Number Theory	DSC	3	0	0	3
4	PHY	Quantum Physics	MC	3	0	2	4
5	MTH	Mechanics I	MC	3	0	0	3
6		Internships	SEC	0	0	8	4
	Total						**22**

L- Lectures T- Tutorial P- Practical Cr.- Credits

Semester 6

S. No	Paper Code	Course Title	Course Category	L	T	P	Cr
1	CSP 311	Artificial Intelligence	DSC	3	0	0	3
2	CSP 314	Discrete Mathematics	DSC	3	0	0	3
3	CSP 312	Software Engineering	DSC	3	0	0	3
4	MTH	Mechanics II	MC	3	0	0	3
5	PHY	Particle Physics	DSC	3	0	0	3
6	PHY	Nuclear Physics	MC	2	0	2	3
	Total						**18**

L- Lectures T- Tutorial P- Practical Cr.- Credits

Note: If the Student get CGPA >= 7.5 then he/she will have to submit the Research Project with 12 Credit.

THIRD EXIT:

The student will be awarded "Bachelor of Science in Computer Science" degree after exit at this point. NCC 3 credits are only earned by those students who are opted NCC

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Semester 7

S.No	Paper Code	Course Title	Course Category	L	T	P	Cr
1	CSP405	Theory of Computer Science	**DSC**	4	0	0	**4**
2	CSP404	Advanced in Operating System	**DSC**	3	0	2	**4**
3	----------	----------	**DS-SEC**	4	0	0	**4**
4	CSP401	Research Methodology	**MC**	4	0	0	**4**
5	CSP402	Internet of Things	**DSC**	3	0	2	**4**
	Total						**20**

DS-SEC (Discipline Specific-Skill Enhancement Course-Core)-(Choose One)

S.No	Paper Code	Course Title	L	T	P	Cr
1	CSP406	Compiler Design	3	0	0	3
2	CSP407	Emerging Trends and Technology	3	0	0	3

L- Lectures T- Tutorial P- Practical Cr.- Credits

Semester 8

S. No	Paper Code	Course Title	Course Category	L	T	P	Cr
1	CSP409	Mobile Computing	**DSC**	4	0	0	**4**
2	CSP411	Digital Image Processing	**DSC**	3	0	2	**4**
3	CSP410*	Major Project	**-------**	0	0	12	**6**
4	CSP412*	Cryptography and Network Security	**MC**	2	0	2	**3**
5	CSP316*	R Programming	**DSC**	3	0	2	**4**
	Total						**20**

L- Lectures T- Tutorial P- Practical Cr.- Credits

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 ***Those students are adopting the research project they are exempted these courses. (12 credit)**

S.No	Paper Code	Course Title	Course Category	L	T	P	Cr
1	CSP415	Research Project	--------	0	0	24	**12**
	Total						**12**

Note: If the Student get CGPA less than 7.5, then He/ She will have to submit the Research Project with 12 Credit.

FOURTH EXIT:

The student will be awarded "Bachelor of Science in Computer Science (Hons.)" degree after exit at this point.

List of Multi-disciplinary open elective courses at DAV University

Sr. No.	Course Name	Faculty/Department
1	Basics of Physics	Physics
2	Basics of Chemistry	Chemistry
3	Basics of Biology	Zoology & Botany
4	Introductory Biotechnology	Biotechnology
5	Introductory Microbiology	Microbiology
6	Functioning of the Human Body	Zoology
7	Introductory Botany	Botany
8	Business Management for Beginners	CBME
9	Fundamental of Mutual Funds	CBME
10	Economics for Beginners	CBME
11	Professional Communication	English
12	Fine Arts	Arts, Fine Arts & Performing Arts
13	Jyotish: 'Eye of the Veda'	Vedic Studies
14	Mathematical Statistics	Mathematics
15	Introductory Journalism	JMC
16	Professional Photography	JMC
17	Library Information Sciences	Library Sciences

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Common courses with credits

Ability-Enhancement Courses	**Cr.**	**Skill-Enhancement Courses**	**Cr.**	**Value-Added Courses**	**Cr.**
Personality Enhancement	1L+1P	Essentials of Entrepreneurship-Thinking and Action	2L+1P	Environmental Studies **(Mandatory)**	2L+1P
Personality Development	2P	Design Thinking	2P	Human Values and Ethics **(Mandatory)**	2L+1T
Behavioural & Life Skills	1L+1P	Design Thinking & Innovation	2L	Gender Sensitization	2L
Global Citizenship in Higher Education	2L	Data Analytics	2L+1P	Professional Ethics	2L
Communication Skills **(Mandatory)** **OR** Cambridge English-I **(Mandatory#)** & Cambridge English-II **(Mandatory#)** *# To be offered in two semesters*	1L+1P 1L+1P 1L+1P	Cyber Security	3 (2L+1P)	Sustainable Development	2L
		Digital Fluency	1L+1P	Green Technologies	2L
Health & Yoga	1L+1P	Fundamentals of Computer programming & IT(FCPIT)	2L	General Studies	2L
Technical Report Writing	2L	Python Programming	3 (2L+1P)	NSS	2 (1L+1P)
Leadership Management	2L	Disaster Preparedness and Planning	2L		
Therapeutic Yoga	1L+1P	Intellectual Property Rights	2L		
Creative & Critical Thinking	1L+1P	Apiculture	2P		

Community Engagement & Social Responsibility	1L+1P	NCC*	3 (2L+1P)		
(Mandatory)					
		LATEX	3 (1L+2P)		
		Programming with FORTRAN	3(2L+1P)		

Notes:

a. Due to the constraint on total number of credits to be restricted under 160 for four year UG programmes, the mandatory courses which may or may not fall under ability-enhancement, skillenhancement (common) or value- added courses can be offered as non-credit course and the student will have to qualify (as Satisfactory/Unsatisfactory) these courses to secure minimum passing marks through the process of assessment as mandated by DAV University.

b. Minimum number of students feasible to run a common course (Ability- enhancement, Skillenhancement (common) and Value-added) will be 20 students.

c. *Pre-requisite to opt NCC is that the student must be in possession of Certificate B or has appeared in B-certificate exam of NCC. NCC course shall run in two semesters of 3 credits (2L+1P) in each semester. Student who wishes to opt for NCC is required to study in two semesters of total 6 credits.

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Semester 1

In hours			
L	**T**	**P**	**Credit**
3	0	0	3

Course Code	**CSP103**						
Course Title	**Algorithm Design and Programming Using C**						
Course Outcomes	On the completion of the course the student will be able to CO1: To define the concept of problem solving and steps to solving problems in computer application are using algorithms, pseudo-codes and flowcharts & sequential, selection and repetition structure. CO2: To understand the Concept of fundamentals of programming & Control structure. CO3: Apply the concepts of Function, arrays, Structure & Union. CO4: Demonstrate the ability to write C programs using pointers and file handling.						
Examination Mode	Theory/ Practical/ Theory + Practical						
Assessment Tools	Written Quiz	Assignment/ Project Work	MSE	MTP	ESE	EPR	ABL/PBL
Weightage	10%	10%	25%	-	50%	-	5%
Syllabus							**CO Mapping**
Unit 1	**Fundamentals of algorithms and programming, Operations and Expressions & Control Structures**						CO1
	Concept: Problem-solving, Problem-solving techniques (Trial & Error, Brainstorming, Divide & Conquer), Steps in problem solving (Define Problem, Analyze Problem, Explore Solution), Algorithms and Flowcharts (Definitions, Symbols), pseudo-codes.						
	Character Set, Identifiers and Key Words, Data Types, Constants, Variables, Expressions, Statements, Symbolic Constants and Operators & its types.						
	Single Character Input, Single Character Output, Entering Input Data More About Scan Functions, Writing Output Data, More About Print Functions, Gets and Puts Functions, Library functions.						
Unit 2	**Decision Making and Looping Statements & Array**						CO2
	Introduction, Decision Making with If–Statement, If Else and Nested If, While And Do-While, For Loop, Jump Statements: Break, Continue, Go to, Switch Statement.						
	Introduction to Arrays, Array Declaration, Single and Multidimensional Array, Memory Representation, Matrices, Strings, String Handling Functions.						
Unit 3	**Functions, Structure and Union**						CO3
	Introduction To Functions, Function Declaration, Function Categories, Standard Functions, Parameters and Parameter Passing, Pass – By Value/ Reference, Recursion, Global and Local Variables, Storage Classes.						
	Declaration of Structure, Accessing Structure Members, Structure Initialization, Arrays of Structure, Nested Structures, Unions.						
Unit 4	**Pointers, Files & Preprocessor Directives**						CO4

	Introduction To Pointers, Address Operator and Pointers, Declaring and Initializing Pointers, Assignment through Pointers, Pointers and Arrays.	
	Introduction, creating a Data File, Opening and Closing a Data File, Processing a Data File.	
	Introduction and Use, Macros, Conditional Preprocessors, Header Files	
Text Book/s	1. Balagurusami E, Programming in ANSIC, New Delhi: Tata McGraw Hill, Fourth Edition (2010).	
Reference Book/s	1. Sprankle, M&J. Hubbard, *Problem solving and programming concepts*, 9th Edition. NJ: Prentice Hall, 2012. 2. Gaddis,T., *Starting out with programming logic and design*, 3rd Edition. Boston: Addison Wesley 2012. 3. Venit, S. &E. Drake, *Prelude to programming: Concepts and design*, 5th Edition. Boston: Addison Wesley, 2011. 4. R.G.Dromy. *How to Solve it by Computer*, 3rd Edition, New Delhi: Pearson Education, 2007. 5. Kanetkar Yashwant P, *Let us C*, New Delhi: BPB Publications, Seventh Edition (2007). 6. Kernighan & Richie, *The C Programming Language*, New Delhi: PHI Publication, Second Edition (2009).	

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In hours			
L	T	P	Credit
3	0	2	4

Course Code	**PHS101**							
Course Title	**Mechanics**							
Course Outcomes	CO1: To enable the students to understand different types of reference frames, Galilean Transformations, concept of collision and non-inertial systems. CO2: To enable the students to understand rotational dynamics and motion of a particle under inverse square central forces, CO3: Students will gain information about Special theory relativity. They will be able to learn concept of relativistic mass and some of its consequences. CO4: Students will be able to verify some of the concepts learnt in the theory courses. They will be trained in performing experiments of Mechanics.							
Examination Mode	Theory+ Practical							
Assessment Tools	**Quiz**	**Assignment**	**ABL/PBL**	**Lab Performance**	**MSE**	**MSP**	**ESE**	**ESP**
Weightage	**10**	**-**	**5**	**-**	**25**	**-**	**35**	**25**
Syllabus								**CO Mapping**
Unit 1	**Fundamentals of Dynamics**							
	Fundamentals of Dynamics: Inertial frames; Galilean transformations; Galilean invariance. Centre of mass. Principle of conservation of momentum. Conservative and non- conservative forces. Potential Energy. Force as gradient of potential energy. Collisions: Elastic and inelastic collisions between particles. Centre of mass and laboratory frames. Various relations between lab and centre of mass frames. **Non-Inertial Systems:** Non-inertial frames and fictitious forces. Uniformly rotating frame, Centrifugal force, Coriolis force and its applications.							1
Unit 2	**Rotational Dynamics and Central force motion**							
	Rotational Dynamics: Angular momentum of a particle and system of particles. Torque. Principle of conservation of angular momentum. Rotation about a fixed axis. Moment of Inertia. Calculation of moment of inertia for rectangular, cylindrical and spherical bodies. **Central force motion:** Central forces, Law of conservation of angular momentum for central forces, Two-body problem and its reduction to equivalent one-body problem and its solution, Concept of effective potential energy and stability of orbits for central potentials of the form kr^n for n = 2 and -1 using energy diagram, discussion on trajectories for n= −2. Solution of Kepler's problem, Kepler's laws for planetary motion, orbit for artificial satellites							2
Unit 3	**Special Theory of Relativity**							

	Michelson-Morley Experiment and its outcome, Postulates of Special Theory of Relativity, Lorentz Transformations, Simultaneity and order of events, Lorentz contraction, Time dilation, Relativistic transformation of velocity, frequency and wave number, Relativistic addition of velocities, Variation of mass with velocity, Massless Particles, Mass-energy Equivalence, Transformation of Energy and Momentum.	3
Unit 4	**List of Experiments**	
	1. To determine the height of a building using a Sextant. 2. To study the Motion of Spring and calculate (a) Spring constant, (b) g and (c) Modulus of rigidity 3. To determine the Moment of Inertia of a Flywheel. 4. To determine the Modulus of Rigidity of a Wire by Maxwell's needle 5. To determine the elastic Constants of a wire by Searle's method. 6. To determine the value of g using Bar Pendulum. 7. To determine the value of g using Kater's Pendulum.	
Text Books	**1. D. Kleppner, R.J. Kolenkow, An introduction to mechanics, New Delhi: McGraw-Hill, 1973.** **2. C.Kittel, W.Knight, et.al. Mechanics, Berkeley Physics, vol.1, New Delhi: Tata McGraw-Hill, 2007.** **3. Resnick, Halliday and Walker, Physics, 8/e. Wiley, 2008.** **8. D.S. Mathur, Mechanics, New Delhi: S. Chand and Company Limited, 2000.** **9. F.W Sears, M.W Zemansky, H.D Young, University Physics. 13/e, Addison Wesley, 1986.** **5. C.L. Arora, B.Sc. Practical Physics**	
Reference Books	**1. G.R. Fowles and G.L. Cassiday, Analytical Mechanics, New Delhi: Cengage Learning, 2005.** **2. R. P. Feynman, R. B. Leighton, M. Sands, Feynman Lectures, Vol. I, Pearson Education, 2008.** **3. R. Resnick, Introduction to Special Relativity, John Wiley and Sons, 2005.** **4. R. L. Reese University Physics, Thomson Brooks/Cole, 2003.** **5. S. Panigrahi and B. Mallick, Engineering Practical Physics, Cengage Learning India Pvt. Ltd, 2015.**	4

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In hours			
L	**T**	**P**	**Credit**
3	-	-	3

Course Code	MAT171							
Course Title	Algebra							
Course Outcomes	On the completion of the course the students will be able to **CO1**: understand System of homogeneous and non-homogeneous linear equations. **CO2**: understand rank of matrix and apply the Cayley Hamilton Theorem. **CO3**: find roots of complex number and learn Fundamental Theorem of Algebra. **CO4**: understand Evaluating roots of polynomials of third and fourth degree, basic notions of Discarte's rule of sign, sturm's process							
Examination Mode	Theory							
Assessment Tools					**MSE**	**MSP**	**ESE**	**ESP**
	Quiz	**Assignment**	**ABL/PBL**	**Lab Performance**				
Weightage	**10**	**10**	**5**	**-**	**25**	**-**	**50**	**-**
Syllabus								**CO Mapping**
Unit 1	**Theory of system of linear equations**							
□	Review of system of linear equations							CO1
□	general theory of system of linear equations							CO1
□	Row and column rank of a matrix							CO1
□	System of homogeneous and non-homogeneous linear equations							CO1
Unit 2	**Rank of Matrix and Cayley Hamilton Theorem**							
□	Matrices and Rank of matrix							CO2
□	Inverse of matrix, Elementary Linear Transformations							CO2
□	Determinants and their properties, Cramer Rule							CO2
□	Cayley Hamilton Theorem							CO2
Unit 3	**Fundamental Theorem of Algebra**							
□	A deeper look at complex Numbers, taking roots of complex numbers							CO3
□	Quick review of operations on polynomials							CO3
□	Divisors and greatest common divisor							CO3
□	Roots of polynomials, Fundamental Theorem of Algebra, corollaries of Fundamental Theorem.							CO3
Unit 4	**Cubic and Biquadratic Polynomials**							
□	Evaluating roots of polynomials of third and fourth degree							CO4

□	Bounds of roots, Sturm's Theorem	CO4
□	Descarte's rule of signs	CO4
□	Approximation of Roots	CO4
Text Books	• A. Kurosh, Higher Algebra, MIR Moscow,1982 • Lipschutz, Seymour and Lipson, Marc *Schaum's Outline of Linear Algebra*, 3rd Edition, McGraw Hill Education, 2017.	
Reference Books	□ Shanti Narayan and P. K. Mittal, A textbook of matrices, S.Chand and Company Limited, 2019. □ Friedberg, S.H., A.J. Insel and L.E. Spence. *Linear Algebra*. Prentice Hall, 2003.	

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Semester - 2

In hours			
L	**T**	**P**	**Credit**
3	0	2	4

Course Code	**CSP104**						
Course Title	**Object Oriented Programming using C++**						
Course Outcomes	On the completion of the course the student will be able to CO1: Discuss the concepts of OOPs. Comparison with the previously developed languages. CO2: Developing the concepts of Classes and object by using real-world examples. CO3: Implement the concepts of Friend function and Inheritance. CO4: Developing the programs using the concept of virtual function and using the concept of file handling. CO5: Interaction with the IDE and help in understanding the concept of OOPs.						
Examination Mode	Theory/ Practical/ Theory + Practical						
Assessment Tools	Written Quiz	Assignment/ Project Work	MSE	MTP	ESE	E P R	ABL/PBL
Weightage	10%	10%	25%	-	50%	-	5%
Syllabus							**CO Mapping**
Unit 1	**Introduction to OOPS & Class Concepts**						CO1,5
	Evolution Of OOP, OOP Features Of C++, Characteristics of Object Oriented Language – Objects, Classes, Inheritance, Reusability, User Defined Data Types, Polymorphism, Overloading, Comparison of C with C++.						
	Class and Objects, Inline Functions, Static Data, Members and Member Functions, Constructors and Destructors.						
	Dynamic Objects, Array of Pointers to Object, Pass By Value Vs. Pass By Reference, Local and Global Class, Nested and Empty Class, Preprocessor Directives, Namespace.						
Unit 2	**Console I/O &Operator Overloading**						CO2
	Hierarchy of Console Stream Classes, Unformatted and Formatted I/O Operations, Manipulators						
	Overloadable Operators, Overloading-Unary and Binary, Arithmetic and Relational Operators, Overloading Subscript, Array, Insertion, Extraction, New and Delete Operators.						
Unit 3	**Friend Function and Type Conversion & Inheritance**						CO3
	Friend Function, Function Overloading, Overloading Operators through Friend Function						
	Basic Type Conversion, Conversion Between Objects and Basic Types, Conversion Between Objects of Different Classes						

□	Derivation Rules, Different Forms of Inheritance, Roles of Constructors and Destructors in Inheritance	
Unit 4	**Virtual Functions & File Handling**	CO4
□	Virtual Functions and Their Needs, Pure Virtual Function, Virtual Destructor, Virtual Derivation, Abstract Class.	
□	Hierarchy of File Stream Classes, Opening and Closing Files.	
□	File Modes, Testing for Errors, File Pointers and Their Manipulations, ASCII & Binary Files, Sequential and Random Access Files	
Text Book/s	1. Balaguruswami E, *Object Oriented Programming In C++*, New Delhi: Tata Mc Graw Hill,2006	
Reference Book/s	1. Stroustrup Bjarne, *The C++ Programming Language*, New Delhi: Addison-Wesley Professional,2000 2. Lafore Robert, *Object Oriented Programming in C++*. Delhi: Sams Publishing, 2000 3. Lippman,Tom Weiss, *C++ Primer*, New Delhi: Addison Wesley, 2005 4. Scildt Herbert, *C++ The Complete Reference*, New Delhi: Tata Mc Graw Hill, 2007	

DAV University, Jalandhar

In hours			
L	**T**	**P**	**Credit**
3	0	2	4

Course Code		**PHS 201**						
Course Title		**Vibrations and Waves**						
Course Outcomes		On the completion of the course the student will be able to **CO1:** Gain knowledge in simple harmonic motion in mechanical and electrical systems **CO2:** Understand the damping mechanism in simple harmonic motion **CO3:** Gain knowledge in forced and coupled mechanical and electrical oscillators **CO4:** Understanding of wave motion concepts and hands on training on the SHM experiments and wave motion related practical						
Examination Mode		Theory/ Practical/ Theory + Practical						
Assessment Tools	**Quiz**	**Assignment**	**ABL/PBL**	**Lab Performance**	MSE	MSP	ESE	ESP
Weightage	**10**	**-**	**5**	**-**	**25**	**-**	**35**	**25**
Syllabus								**CO Mapping**
Unit 1	***Simple Harmonic motion***							CO1
	Hooke's law, Equation of Simple harmonic motion, Frequency, Amplitude, Displacement, Velocity, Acceleration, and phase difference of SHM, Energy of a simple harmonic oscillator, Compound pendulum, Torsional pendulum, Kater's pendulum, Simple harmonic oscillations in electrical system, Principle of Superposition Harmonic Oscillations, Superposition of Two Harmonic Motions of Same Frequency, Lissarjous figures and its applications, Anharmonic Oscillations.							
Unit 2	***Damped oscillations***							
	Damped simple harmonic motions in mechanical and electrical system, Decay of free vibrations due to damping, Differential equation of damped harmonic motion and its solution, Types of damping, Determination of damping coefficient of a damped vibrating system – Logarithmic decrement, Relaxation time, and Quality Factor, Forced Vibrations – Mechanical and Electrical Forced Oscillator, Transient and steady state oscillations.							
Unit 3	***Forced oscillations***							CO3

	Forced Mechanical Oscillators - Displacement, Velocity and Acceleration, Variation of Displacement, Velocity and Acceleration with driving force frequency, Power supplied to Forced Oscillator by the driving force, Power dissipated against frictional force, Variation of power with driving force frequency, Quality factor, Amplification factor of forced oscillator Coupled Oscillations - Mechanical and Electrical Coupled Oscillators, Stiffness Coupled Oscillators, Potential energy of coupled pendulums, Equation of motion of two coupled	
	pendulums, Inductive coupling of electrical oscillators.	
Unit 4	***Wave motion and practicals***	CO4
	Types of Waves - Longitudinal and Transverse Waves, Characteristics of Wave Motion, Differential Equation of Wave Motion, Equation of a Progressive Simple Harmonic Waves, Energy in Progressive waves, Velocities of Wave motion – Particle, Wave, Group Velocities, Relation between Particle Velocity and Wave Velocity, Velocity of Transverse Waves, Characteristics impedance of string, Reflection and Transmission of Waves on a string at a Boundary, Reflection and Transmission Coefficients – Amplitude and Energy, Stationary Waves and Waves on a string of fixed length, Nodes and Anti-nodes, Energy of a Vibrating String 1. To determine the frequency of a tuning fork using a sonometer. 2. To verify the laws of transverse vibrations of stretched strings using a sonometer 3. To determine the frequency of AC mains using a sonometer and an electromagnet. 4. To find the velocity of sound in the material of the given rod with a Kundt's tube. 5. To measure the logarithmic decrement, coefficient of damping, relaxation time and quality factor of a simple damped pendulum.	
Text Books	1. S P Puri, Vibrations and Waves, Macmillan India Ltd.,2004. 2. H. J. Pain, Physics of Vibrations and Waves, John Wiley and Sons, 2013.	
Reference Book/s	1. N.K. Bajaj, Physics of Waves and Oscillations, Tata McGraw Hill, 1998 2. Vibration and Waves by S Chand Publishers	

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In hours			
L	**T**	**P**	**Credit**
3	-	-	3

Course Code	MAT172						
Course Title	Ordinary Differential Equations						
Course Outcomes	On the completion of the course the student will be able to **CO1**: find solutions of boundary value problems and understand Basic Existence Theorem. **CO2**: check the exactness of differential equation $Mdx + Ndy = 0$, finding integrating factors of non-exact differential equation. **CO3**: find solutions of Linear differential equation and understand differential operators **CO4**: apply method of Undetermined coefficients, variation of parameters to find solution of non-homogeneous equation.						
Examination Mode	Theory						
Assessment Tools	**Quiz**	**Assignment**	**ABL/PBL**	**Lab Performance**	**MSE**	**MSP**	**ESE**	**ESP**
Weightage	**10**	**10**	**5**	**-**	**25**	**-**	**50**	**-**
Syllabus								**CO Mapping**
Unit 1	**Boundary Value Problems**							
□	Origin of Differential equations, Basic definitions							CO1
□	Family of Solutions, Geometric Interpretation							CO1
□	Boundary Value Problem							CO1
□	Basic Existence Theorem (Statement)							CO1
Unit 2	**Exact Differential Equations**							
□	Equations of Order One, Separation of Variables							CO2
□	Exact Equations, Linear Equations							CO2
□	Integrating Factors							CO2
□	Bernoulli's equation, Elementary applications							CO2
Unit 3	**LDE with constant coefficients**							
□	General Linear equation: General Solutions, Linear independence of solutions							CO3
□	Differential operators							CO3
□	Linear equations with constant coefficients							CO3
□	Auxiliary equations							CO3
Unit 4	**Variation of Parameter method and Non-linear equation**							
□	Non-Homogeneous equation: Method of Undetermined coefficients							CO4
□	Variation of Parameter Method							CO4
□	Non-Linear Equations							CO4

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Text Books	• EARL D. RAINVILLE AND P. E. BENEDIET, *Elementary differential equations*, Seventh Edition, Macmillian, Publishing Company, 1989.	
Reference Books	• S. L. ROSS, *Differential Equations*, 3rd ed., John Wiley and Sons, India 2004.	

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L	T	P	Credits	Marks
0	0	2	1	50

Course Title: Object Oriented Programming Structures Laboratory
Course Code: CSP104

- Implementation of OOP concepts using C++
- Write program in ‘C++’ language Using input and output statements Using control statements.
- Using functions.
- Using array
- Using Classes and implementation of Constructor and Destructor.
- Using files.
- Using OOP’s Concepts (Inheritance, Polymorphism, Encapsulation, Friend and Static Functions, Exception Handling)

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Semester 3

In hours			36
L	**T**	**P**	**Credit**
3	0	2	4

Course Code	**CSP203**						
Course Title	**Database Concepts**						
Course Outcomes	On the completion of the course the student will be able to CO1: To understand the basic concepts and the applications of database systems. CO2: To understand the basic concepts of data models and ER Diagrams. CO3: To understand the relational database design principles and apply normalization for the development of application software's CO4: To Master the basics of SQL and construct queries using SQL.						
Examination Mode	Theory + Practical						
Assessment Tools	Written Quiz	Assignment/ Project Work	MSE	MTP	ESE	EPR	ABL/PBL
Weightage	10%	10%	25%	-	50%	-	
Syllabus							**CO Mapping**
Unit 1	**An Overview of DBMS (08 Hours)**						CO1
	Concept of File Processing Systems and Database Systems Database Administrator and his Responsibilities Physical and Logical Data Independence						
	Three level Architecture of Database System The External Level, Conceptual Level, The Internal Level						
Unit 2	**Introduction to Data Models (08 Hours)**						CO2
	Entity Relationship Model, Hierarchical Model , Network and Relational Model , Comparison of Network, Hierarchical and Relational Model						
	Data base design and ER diagrams – ER Model - Entities, Attributes and Entity sets – Relationships and Relationship sets – ER Design Issues – Concept Design – Conceptual Design for University or Enterprise.						
Unit 3	**Relational Databases (07 Hours)**						CO3
	Introduction , Terms a. Relation b. Tuple c. Attribute d. Cardinality e. Degree f. Domain						
	Keys (a) Super Key (b) Candidate Key (c) Primary Key (d) Foreign Key						
	Relational Algebra Operations (a.) Select (b.) Project (c.) Union (d.) Difference (e.) Intersection (f.) Cartesian Product						
Unit 4	**Relational Database Design (05 Hours)**						CO3
	Introduction , Anomalies of un normalized database , Normalization , **Normal Forms**: INF, 2NF, 3NF, BCNF, 4th NF, 5th NF						
	Database Security, Integrity and Control						

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Unit 5	**SQL (Structured Query Language) (08 Hours)**	CO4
	Introduction , History Of SQL , Basic Structure , DDL Commands , DML Commands , DCL Command, Simple Queries , Nested Queries , Aggregate Functions , Clauses	
	Join Methods, Union, Intersection, Minus, Views, Sequences, Indexing, Subquery.	
Practicals	**List of experiments:** Task 1. Introduction to SQL and installation of SQL Server / Oracle. Task 2. Data Types, Creating Tables, Retrieval of Rows using Select Statement Task 3. Conditional Retrieval of Rows, Alter and Drop Statements. Task 4. Working with Null Values, matching a Pattern from a Table Task 5. Ordering the Result of a Query, Aggregate Functions, Grouping the Result of a Query, Update and Delete Statements. Task 6. Set Operators, Nested Queries Task 7. Joins, Sequences. Task 8. Views, Indexes Task 9. Database Security and Privileges: Grant and Revoke Commands, Commit and Rollback Commands.	
Text Book/s	1. Data base System Concepts, Silberschatz, Korth, McGraw hill, Sixth Edition. 2. Data base Management Systems, Raghurama Krishnan, Johannes Gehrke, TATA McGrawHill 3rd Edition.	
Reference Book/s	1. Fundamentals of Database Systems, Elmasri Navathe Pearson Education. 2. An Introduction to Database systems, C.J. Date, A.Kannan, S.Swami Nadhan, Pearson, Eight Edition for UNIT III 3. Simplified Approach to DBMS– Kalyani Publishers	

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L	**T**	**P**	**Credit**
3	0	0	3

Course Code	**MAT 271**							
Course Title	Real Analysis							
Course Outcomes	On the completion of the course the student will be able to CO1: understand the algebraic and order properties of real numbers CO2: understand the interior points, limit points and isolated points of sets. Students will learn about open and closed sets. CO3: understand elementary properties of sequences CO4: understand convergence and divergence of positive terms series and alternative series							
Examination Mode	Theory							
Assessment Tools	**Quiz**	**Assignment**	**ABL/PBL**	**Lab Performance**	**MSE**	**MSP**	**ESE**	**ESP**
Weightage	**10**	**10**	**5**	**-**	**25**	**-**	**50**	**-**
Syllabus								**CO Mapping**
Unit 1	**Introduction to Real Numbers**							CO1
	Review of Algebraic and order properties of *R*, What is Latex,							CO1
	Idea of countable sets, uncountable sets. Bounded Sets, Unbounded sets,							CO1
	Suprema and Infima, The Completeness Property of *R*, The Archimedean Property							CO1
	Density of Rational (and Irrational) numbers in *R*.							CO1
Unit 2	**Sets in IR (Intervals):**							CO2
	Neighborhood of a point. Properties of Neighbourhoods. Interior point. Open set. Union and Intersection of open sets.							CO2
	Limit point and isolated point of a set. Definition of derived set. Illustrations of Bolzano-Weierstrass theorem for sets.							CO2
	Closed set. Complement of open set and closed set. Union and intersection of closed sets as a consequence.							CO2
	No nonempty proper subset of *R* is both open & closed.							CO2
Unit 3	**Sequences:**							CO3
	Sequences, Bounded sequence, Convergent sequence,							CO3
	Limit of a sequence. Limit Theorems, Monotone Sequences, Monotone Convergence Theorem.							CO3
	Subsequences, Divergence Criteria, Monotone Subsequence Theorem (statement only), Bolzano Weierstrass Theorem for Sequences.							CO3
	Cauchy sequence, Cauchy's Convergence Criterion.							CO3

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Unit 4	**Infinite series:** Infinite series, convergence and divergence of infinite series Cauchy Criterion	CO4
□	**Tests for convergence:** Comparison test, Limit Comparison test, Ratio Test, Cauchy's nth root test	CO4
□	Alternating series, Leibniz test.	CO4
Text Books	**1.** Bartle, R.G. and D.R. Sherbert. Introduction to Real Analysis, 4th Ed. Singapore: John Wiley and Sons (Asia) Pvt. Ltd., 2002. **2.** Rudin, W. Principles of Mathematical Analysis, 3rd Edition. New Delhi: McGraw-Hill Inc., 1976.	
Reference Books	**1.** Berberian, S.K. A First Course in Real Analysis. New York: Springer Verlag, 1994. **2.** Thomson, B.S., A.M. Bruckner and J.B. Bruckner. Elementary Real Analysis. Prentice Hall, 2001. **3.** Apostol, Tom M., Mathematical Analysis, 2nd Edition, Pearson Education, 1974.	

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In hours			45
L	T	P	Credit
3	0	2	4

Course Code	PHS202						
Course Title	Digital Systems and Applications						
Course Outcomes	**On the completion of the course, the student will be able to** CO1: Understand the difference between analog and digital circuits and gain knowledge about Boolean algebra CO2: Explain Data processing circuits and Arithmetic circuits CO3: Understand the Sequential Circuits like Flip flops, Registers, Counters CO4: Get direct hand on experience of working with fundamental logic gates, Boolean functions, parity checkers, and sequential systems by choosing Flip-Flop as a building block, and counters to provide a basic idea about memory including RAM, and ROM Demonstrate both combinational circuits and sequential circuits by employing NAND as building blocks and Adders, Subtractors, and Shift Registers.						
Examination Mode	Theory						
Assessment Tools	**Quiz**	**Assignment**	**ABL/P BL**	**Lab Performance**	**MSE**	**MS P**	**ES E**	**ESP**
Weightage	**10**		**5**	**-**	**25**	**-**	**35**	**25**
Syllabus								**CO Mapping**
Unit 1	**Digital Circuits and Boolean algebra:**							
	Difference between Analog and Digital Circuits. Binary Numbers, Decimal to Binary and Binary to Decimal Conversion, BCD, Octal and Hexadecimal numbers, AND, OR and NOT Gates (realization using Diodes and Transistor); NAND and NOR Gates as Universal Gates; XOR and XNOR Gates and application as Parity Checkers, De Morgan's Theorems; Boolean Laws; Simplification of Logic Circuit using Boolean Algebra; Fundamental Products, Conversion of a Truth table intoEquivalent Logic Circuit by (1) Sum of Products Method and (2) Karnaugh Map.							1
Unit 2	*Arithmetic circuits and Data processing circuits:*							
	Binary Addition. Binary Subtraction using 2's Complement;Half and Full Adders, Half & Full Subtractors, 4-bit binary Adder/Subtractor; Basic idea of Multiplexers, De-multiplexers, Decoders, Encoders							2

Unit 3	**Sequential Circuits:**	

	Flip Flops: SR, D, and JK Flip-Flops; Clocked (Level and Edge Triggered) Flip-Flops, Preset and Clear Operations, Race-around conditions in JK Flip-Flop, M/S JK Flip-Flop. **Shift registers:** Serial-in-Serial-out, Serial-in-Parallel-out, Parallel-in-Serial-out andParallel in-Parallel-out (only up to 4 bits). **Counters (4 bits):** Ring Counter, Asynchronous counters, Decade Counter. Synchronous Counter. **Computer Organization:** Input/output Devices; Data storage (idea of RAM and ROM); Computer memory,	3
Unit 4	**Digital Electronic Experiments:**	
	1. To verify the truth table of AND, OR, NOT, NAND, NOR Gate USING DTL Kit. 2. To verify and design AND, OR, NOT and XOR gates using NAND gates. 3. To design and verify truth table of Half Adder, Full Adder and 4-bit binary Adder. 4. Parity generator and checker. 5. To build Flip-Flop (RS, Clocked RS, D-type and JK) circuits using NAND gates. 6. To build JK Master-slave flip-flop using Flip-Flop ICs 7. To build a 4-bit Counter using D-type/JK Flip-Flop ICs and study timing diagram.	4
Text Books	1. G. S. Bains, Digital Circuits and Logic Design, PBS Education, 2013 2. A.A Kumar, Fundamentals of digital Circuits, Prentice- Hall India, 2004 3. R. L. Tokheim, Experiments Manuals for Digital Electronic, MCGraw Hill, 2003	
Reference Books	1. A. P. Malvino and D. P. Leach, Digital Principles and Applications. New Delhi: Tata McGraw Hill, 1986. 2. J. Milliman and H. Taub, Pulse, Digital and Switching Waveforms. New Delhi: Tata McGraw Hill, 1992. 3. A. Mottershead, Electronic Devices and Circuits. New Delhi: Prentice Hall, 1977.	

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Semester 4

L	T	P	Credits
4	0	0	4

Course Code	**CSP206**						
Course Title	Operating Systems						
Course Outcomes	CO1-To understanding CPU Scheduling, Synchronization, Deadlock Handling and CO2-Comparing CPU Scheduling Algorithms. Solve Deadlock Detection Problems. CO3-To describe the role of paging, segmentation and virtual memory in operating systems. CO4-To defining I/O systems, Device Management Policies and Secondary Storage Structure and Evaluation of various Disk Scheduling Algorithms.						
Examination Mode	Theory+ Practical						
Assessment Tools	Written Quiz	Assignment/ Project Work	MSE	MTP	ESE	EPR	ABL/PBL
Weightage	10%	10%	25%	-	50%	-	
Syllabus							**CO Mapping**
Unit 1	**Introduction to Operating System (15 Hours)**						CO1
	• OS, History of OS, Types of OS • Functions/operations of OS, User services/jobs, system calls • Traps, architectures for operating systems						
	Process Management • Process overview, Process states • Interrupt mechanism						
Unit 2	**CPU Scheduling and Process Synchronization(18 hours)**						CO2
	Scheduling algorithms Pre-emptive scheduling & Non-Pre-emptive scheduling Levels of schedulers Process Synchronization, Critical section and mutual exclusion problem Classical synchronization problems, Multithreading.						
	System Deadlock Deadlock characterization, Deadlock prevention and avoidance Deadlock detection and recovery, practical considerations						

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Unit 3	**Storage Management (15 Hours)**	**CO3**
	Storage allocation methods: Single contiguous allocation, Multiple contiguous allocation	
	Memory Management • Paging, Segmentation combination of Paging and Segmentation • Virtual memory concepts, Demand Paging, Page replacement Algorithms • Thrashing. Address Protection, • Cache memory, hierarchy of memory types, associative memory.	
Unit 4	**File Management (12 Hours)**	**CO4**
	• Overview of File Management System • Disk Space Management, Directory Structures • Protection Domains, Access Control Lists, Protection Models Queue management, File and directory systems	
	Device Management • Goals of I/O software, Design of device drivers, Device scheduling policies • FCFS, SSTF, SCAN, CSCAN, LOOK, CLOOK	
Text Book/s	1. Galvin and Silberschatz A., *Operating System Concepts*, Eigth Addition, New York: J. Wiley & Sons, 2009.	
Reference Book/s	1. Crowley, *Operating Systems: A Design Oriented Approach*, New Delhi: Tata McGraw Hill, 2008. 2. Donovan J.J, *Systems Programming*, New York: McGraw Hill, 1972. 3. Dhamdhere. D.M, *System Programming and Operating Systems*, New Delhi: Tata McGraw Hill, 1999. 4. Madnick and Donovan, *Operating System*, New York: McGraw Hill, 1978. 5. Beck Leland L., *System Software*, Delhi: Pearson Education, 2000. 6. Henson P.B., *Operating System Principles*, Delhi: Prentice Hall 7. Tenenbaum A.S., *Operating System: Design and Implementation*, New Delhi: PHI, 2013. 8. Silberschatz, Abraham, et al. Operating System Concepts. United Kingdom, Wiley, 2021.	

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Hours			36
3	0	2	4

Course Code	**CSP204**						
Course Title	**Data Structures**						
Course Outcomes	On the completion of the course the student will be able to CO1: Student will be able to handle operation like searching, insertion, deletion, traversing on various Data Structures; CO2: Student will able to write an algorithm Selection Sort, Bubble Sort, Insertion Sort, Quick Sort, Merge Sort; CO3: Students will be able to choose appropriate Data Structure as applied to specific problem definition; CO4: Implement Various searching algorithms and become familiar with their design methods.						
Examination Mode	Theory and Practical						
Assessment Tools	Written Quiz	Assignment/ Project Work	MSE	MTP	ESE	EPR	ABL/PBL
Weightage	10%	10%	25%	-	50%	-	
Syllabus							**CO Mapping**
Unit 1	**Introduction (08 Hours)**						CO1
	Primitive and Composite Various Data Structures, Common Operations on Data Structures, Algorithm Complexity, Time-Space Tradeoff Between Algorithms, Complexity of Algorithms						
	String: Strings as ADTs, Representation and Manipulation, String Operations.						
	Arrays Arrays Defined, Representing Arrays in Memory, Various Operations on Linear Arrays. Bubble Sort. Linear Search, Binary Search Records, Matrices, Sparse Matrices						
Unit 2	**Linked Lists, Stacks, Queues (08 Hours)**						CO2
	Types of Linked Lists, Representing Linked Lists in Memory, traversing a linked List, Searching in a linked list, Memory Allocation and Garbage Collection, Insertion and deletion in a linked list. Circular Linked List. Advantage of Using Linked Lists Over Arrays, Various Operation on Linked Lists						

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	Stacks Description of Stack Structure, Implementation of Stack Using Arrays and Linked Lists, Applications of Stacks: Expression Conversion and evaluation – corresponding algorithms. QuickSort	
Unit 3	**Queues, Trees, Graphs, Heaps (08 Hours)**	CO3
	Queues Implementation of Queue Using Linked Lists , Circular Queues, De-Queues,	
	Priority Queues.	
	Trees Description of Tree Structure and Its Terminology, Binary Tree, representation in memory, Traversing Binary Trees, Traversal Algorithms using Stacks.	
	Graphs Representation of Graphs and Applications: Adjacency Matrix, Path Matrix Warshall's Algorithm, Linked Representation of a Graph Traversing a Graph: DFS and BFS, Spanning Trees. **Heaps** Description of Heap Structure, Implementing Heaps Using Arrays	
Unit 4	**Searching and Sorting Algorithms (08 Hours)**	**CO4**
	Linear Search, Binary Search Insertion Sort, Selection Sort, Bubble Sort, radix Sort, Merge Sort, Quick Sort	
	Files Operations on Files, Types of Files **File Organizations**: Sequential Files, Indexed Sequential File, Directed Files and Multikey Files	
Practical:	**List of Experiment:** Task 1: Write a program to insert a new element at end as well as at a given position in an array. Task 2: Write a program to delete an element from a given array whose value is given or whose position is given. Task 3: Write a program to find the location of a given element using Linear Search. Task 4: Write a program to find the location of a given element using Binary Search. Task 5: Write a menu driven program to perform following insertion operations in a single linked list: i. Insertion at beginning ii. Insertion at end iii. Insertion after a given node iv. Traversing a linked list Task 6: Write a program to implement push and pop operations on a stack using linear array. Task 7: Write a program to convert an infix expression to a postfix expression using stacks. Task 8: Write a program to evaluate a postfix expression using stacks. Task 9: Program to sort an array of integers in ascending order using bubble sort. Task 10: Program to sort an array of integers in ascending order using selection sort Task 11: Program to traverse graphs using BFS. Task 12: Program to traverse graphs using DFS.	
Text Book/s	"Data Structures with C (Schaum's Outline Series)", Seymour Lipschutz, 1st edition, McGraw Hill Education	

Reference Book/s	1) "Fundamentals of Data Structures", Illustrated Edition by Ellis Horowitz, Sartaj Sahni, Computer Science Press. 2) Algorithms, Data Structures, and Problem Solving with C++", Illustrated Edition by Mark Allen Weiss, Addison-Wesley Publishing Company. 3) "Classic Data Structures", Samanta and Debasis, 2nd edition, PHI publishers. 4) Karumanchi, Narasimha. Data Structures and Algorithms Made Easy: To All My Readers : Concepts, Problems, Interview Questions. India, CareerMonk Publications, 2016.	

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In hours			36
L	T	P	Credit
3	0	2	4

Course Code	**CSP208**						
Course Title	**Computer Networks**						
Course Outcomes	On the completion of the course the student will be able to CO1: Interaction with different hardware devices present in computer networks and discuss various network models. CO2: Interaction with data link layer and its protocols. CO3: Interaction various Routing algorithms. In addition to that functionality of network layer. CO4: Functionality of Transport layer and Implementation of Application layer protocols in real-world scenarios.						
Examination Mode	Theory + Practical						
Assessment Tools	Written Quiz	Assignment/ Project Work	MSE	MTP	ESE	EPR	ABL/PBL
Weightage	10%	10%	25%	-	50%	-	
Syllabus							**CO Mapping**
Unit 1	**Introduction to Data Communication (08 Hours)**						CO1
	Components of Data Communication, Data Representation Transmission Impairments, Switching, Modulation, Multiplexing **Review of Network Hardware:** LAN, MAN, WAN Wireless networks, Internetworks **Review of Network Software:** Layer, Protocols, Interfaces and Services **Review of Reference Models:** OSI, TCP/IP and their comparison **Physical Layer** **Transmission Media**: Twisted pair, Coaxial cable, Fibre optics, Wireless transmission (Radio, Microwave, Infrared)						
Unit 2	**Data Link Layer (08 Hours)**						CO2
	• Error Correction and Detection • Framing, Noiseless Channels and Noisy Channels • Multiple Access Protocol (ALOHA, CSMA, CSMA/CD, CSMA/CA) • Wired LANs						
Unit 3	**Network Layer (08 Hours)**						CO3
	• Logical Addressing, Internet Protocol IPv4 and IPv6 • Design Issues, Routing Algorithms (Shortest Path, Flooding, Distance Vector, Hierarchical, Broadcast, Multicast) Internetworking, IP Protocol, ARP, RARP.						
Unit 4	**Transport Layer (08 Hours)**						CO4
	• Flow Control, Buffering • Internet Transport Protocol (TCP and UDP)						

	• Congestion Control Algorithms (Leaky bucket, Token bucket, Load shedding)	
	Application Layer • Domain name system, Email, File transfer protocol • HTTP, HTTPS, World Wide Web.	
Practical:	**List of Experiment:** Task 1. Specifications of latest desktops and laptops. Task 2. Familiarization with Networking Components and devices: LAN Adapters, Hubs, Switches, Routers etc. Task 3. Familiarization with Transmission media and Tools: Co-axial cable, UTP Cable, Crimping Tool, Connectors etc. Task 4. Preparing straight and cross cables. Task 5. Study of various LAN topologies and their creation using network devices, cables and computers. Task 6. Configuration of TCP/IP Protocols in Windows and Linux. Task 7. Implementation of file and printer sharing. Task 8. Designing and implementing Class A, B, C Networks Task 9. Subnet planning and its implementation Task 10. Installation of ftp server and client	
Text Book/s	Tanenbaum. Andrew S. , Computer Networks, 4th Edition, New Delhi: PHI, 2013.	
Reference Book/s	• Forouzan B. A., Data Communications and Networking, Fourth Edition, New Delhi: Tata McGraw Hill, 2003. • Stalling W, Data & Computer Communications, New Delhi: PHI, Ninth Edition 2010. • Scott, Russell. Computer Networking: This Book Includes: Computer Networking for Beginners and Beginners Guide (All in One). N.p., Russell Scott, 2021.	

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In hours			36
L	T	P	Credit
3	0	0	3

Course Code	MAT272						
Course Title	Analytical Geometry						
Course Outcomes	On the completion of the course the student will be able to CO1: Understand the fundamental concepts of pair of straight lines and circle CO2: Understand the conics (parabola, ellipse and hyperbola) and related notions CO3: Understand the sphere and its properties CO4: Understand the cylinder and cone and its properties						
Examination Mode	Theory						
Assessment Tools	Written Quiz	Assignment/ Project Work	MSE	MTP	ESE	EPR	ABL/PBL
Weightage	10%	10%	25%	-	50%	-	5%
Syllabus							**CO Mapping**
Unit 1	**Pair of Straight lines and Circle**						
	Change of Axes- Translation and rotation of axes, general transformation, invariants						CO1
	Pair of Straight lines- Homogeneous equation of second degree, angle between pair of straight lines, joint equation of the angle bisectors, joint equation of lines joining origin to the intersection of a line and a curve						CO1
	Circle: General equation of circle, tangents and normal, pair of tangents from a given point, chord of contact, pole and polar, equation of chord in terms of mid-point						CO1
	Angle of intersection and orthogonality of two circles, radical axis, coaxial family of circles.						CO1
Unit 2	**Parabola, Ellipse and Hyperbola**						
	Standard equation of Parabola, tangent and normal, tangents from a point, chord of contact, pole and polar, equation of chord in terms of midpoint, diameter						CO2
	Standard equation of Ellipse, tangent and normal, tangents from a point, chord of contact, pole and polar, equation of chord in terms of midpoint, diameter, conjugate diameters of ellipse.						CO2
	Standard equation of Hyperbola, tangent and normal, tangents from a point, chord of contact, pole and polar, equation of chord in terms of midpoint, diameter, conjugate diameters of hyperbola.						CO2
	Classification of the second degree equation $S = ax^2 + 2hxy + by^2 + 2gx + 2fy + c = 0$						CO2
Unit 3	**Sphere and cone**						
	Sphere- Equation of a sphere and its properties, the tangent plane, plane of contact						CO3
	the polar plane, angle of intersection of two spheres						CO3
	Equation of a cone, enveloping cone of sphere						CO3

□	intersection of cone with a line, right circular cone	CO3
Unit 4	**Cylinder and Coinicoids**	
□	equation of cylinder	CO4
□	enveloping cylinder, right circular cylinder	CO4
□	Conicoids- General equation of the second degree in three variables, equations of central conicoids (the ellipsoid, hyperboloid of one and two sheets)	CO4
□	intersection of line with a conicoid	CO4
Text Books	1. Narayan, S. and P.K. Mittal, Analytical Solid Geometry, S. Chand & Company Pvt. Ltd., New Delhi, 2008 2. P.K. Jain and Khalil Ahmad : A Text Book of Analytical Geometry of Two Dimensions, Wiley Eastern Ltd., 1999	
Reference Books	1. Gorakh Prasad and H.C. Gupta : Text Book on Coordinate Geometry, Pothishala Pvt. Ltd., Allahabad, 1955. 2. S. L. Loney : The Elements of Coordinate Geometry, Macmillan and Company, London, 2 nd Edition 2007.	

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In hours			
L	**T**	**P**	**Credit**
3	0	2	4

Course Code	**PHS 211**							
Course Title	**Optics**							
Course Outcomes	On the completion of the course, the student will be able to CO1: understand interference phenomena and measurement techniques CO2: learn diffraction principles and resolving power criteria CO3: study light polarization, double refraction, and optical activity etc. CO4: conduct experiments on wavelengths and optical properties							
Examination Mode	Theory + Practical							
Assessment Tools	**Quiz**	**Assignment**	**ABL/PBL**	**Lab Performance**	**MSE**	**MSP**	**ESE**	**ESP**
Weightage	**10**		**5**	**-**	**25**	**-**	**35**	**25**
Syllabus								**CO Mapping**
Unit 1	**Interference**							
	Interference: Division of amplitude and division of wave-front, Young's Double Slit experiment, Lloyd's Mirror and Fresnel's Biprism, Phase change on reflection: Stokes' treatment, Interference in Thin Films, parallel and wedge-shaped films, Fringes of equal inclination (Haidinger Fringes); Fringes of equal thickness (Fizeau Fringes), Newton's Rings: measurement of wavelength and refractive index, Michelson's Interferometer: Idea of form of fringes, Determination of wavelength, Wavelength difference, Refractive index, and Visibility of fringes.							1
Unit 2	**Fresnel and Fraunhoffer diffraction**							
	Difference between interference and diffraction, Fraunhoffer diffraction-Single slit; Circular disc, Airy disc, Double Slit. Multiple slits and Diffraction grating, Diffraction of N slits and its discussion, Diffraction grating, Missing orders, dispersive power, prism and grating, Rayleigh Criterion for resolving power, Resolving power of plane transmission grating, Fresnel Diffraction, Huygen-Fresnel theory, Fresnel's principle of diffraction, Half-period zones, Zone plate, Diffraction at circular aperture, Diffraction at opaque circular disc, Fresnel Diffraction pattern of a straight edge, a slit and a wire, Cornu's spiral, Difference between Fresnel and Fraunhoffer diffraction							2
Unit 3	**Polarization**							
	Transverse nature of light waves. Plane polarized light – production and analysis. Circular and elliptical polarization, Polarization by							3

	transmission and reflection, Malus Law, Brewster's Law, Polarization by refraction, anisotropic crystals, Theory of double refraction, Elliptically and circularly polarized light, Quarter wave and half wave plates, Production and detection of polarized light. Nicol Prism, Optical activity, specific rotation. Half shade polarimeter	
Unit 4	***Practical Experiments***	
	1. To determine wavelength of sodium light using Newton's Rings. 2. To determine the wavelength of Laser light using Diffraction of Single Slit. 3. To study the wavelength of spectral lines of sodium light using plane transmission grating. 4. To study the specific rotation of sugar solution Laurent's half shade polarimeter method 5. To compare the focal length of two lenses by Nodal slide method.	4
Text Books	1. N. Subramanayam, B. Lal, & M. N. Avadhamulu, Textbook of Optics. New Delhi: S. Chand & Company, 2006. 2. A. Ghatak,Optics. New Delhi: Tata McGraw Hill Publication, 2008	
Reference Books	1. F. A. Jenkins and H. E. White Fundamentals of Optics, McGraw-Hill , 1976. 2. H. R. Gulati and D. R. Khanna Fundamentals of Optics, R. Chand Publications, 1991.	

DAV University, Jalandhar

L	T	P	Credit
3	0	2	4

Course Code	**PHS204**							
Course Title	**Thermal and Statistical Physics**							
Course Outcomes	On the completion of the course the student will be able to CO1: Understand the basic concepts of thermodynamics, such as thermodynamic variables, state function, equilibrium, cyclic processes, entropy, and the laws of thermodynamics. Also, study the Carnot engine and heat pump. CO2: Solve Maxwell's thermodynamic relations and their applications. Learn various systematic experimental methods to achieve very low temperatures near absolute zero. CO3: Explain the statistical behavior of Maxwell-Boltzmann, Bose-Einstein, and Fermi-Dirac statistics and their applications. CO4: Apply analytical techniques and graphical analysis to the experimental data.							
Examination Mode	Theory + Practical							
Assessment Tools		**Quiz**	**Assignment**	**ABL/PBL**	**Lab Performance**	**MSE**	**MSP**	**ESE**	**ESP**
Weightage		**10**		**5**	**-**	**25**	**-**	**35**	**25**
Syllabus									**CO Mapping**
Unit 1	**BASIC THERMODYNAMICS**								
	Laws of Thermodynamics, zeroth law, indicator or PV diagrams, work done, internal energy, Carnot cycle, Carnot's engine. Entropy as a thermodynamic variable; reversible and irreversible processes, Principle of increase of entropy, Statistical basis of entropy, Thermodynamic scale of temperature; its identity with perfect gas scale, impossibility of attaining absolute zero.								1
Unit 2	**MAXWELL RELATIONS**								
	Thermodynamic potentials and equilibrium of thermodynamic systems, Maxwell's equations, Clausius-Clapeyron equation, Joule Thomson effect, Use of Joule Thomson effect in liquefaction of gasses, Low temperatures: Production and measurement of very low temperatures, adiabatic demagnetization, Phase transitions of first and second orders, phase diagrams of Helium, Gibbs phase rule and its applications.								2

Unit 3	**STATISTICAL PHYSICS**	
	Scope of statistical physics, micro and macro states, thermodynamic probability distribution of n particles in two compartments, deviation from the state of maximum probability; equilibrium state of dynamic system, distribution of distinguishable particles in compartments and cells, phase space and its division into cells, Boltzmann statistics for ideal gas, Bose-Einstein statistics and its applications to photon gas, Blackbody Radiation, Spectral distribution of Blackbody radiation, Planck's Law of Blackbody Radiation, Fermi Dirac statistics and its application to electron gas, comparison of the three statistics.	3
Unit 4	**Practical Experiments**	
	1. To determine the Coefficient of Thermal Conductivity of Cu by Searle's Apparatus. 2. To determine the Coefficient of Thermal Conductivity of a bad conductor by Lee and Charlton's disc method. 3. To determine the Temperature Coefficient of Resistance by Platinum Resistance Thermometer (PRT). 4. To study the variation of Thermo-Emf of a Thermocouple with Difference of Temperature of its two Junctions. 5. To determine the value of Stefan's Constant of radiation. 6. To find the thermal conductivity of copper 7. Measurement of Planck's constant using black body radiation.	4
Text Books	1. C. S Helrich, Modern Thermodynamics with Statistical Mechanics. Berlin: Springer, 2009. 2. R.H. Swendsen, An Introduction to Statistical Mechanics & Thermodynamics. Oxford: Oxford University Press, 2012. 3. V.S. Bhatia, Statistical Physics and Thermodynamics. New Delhi: Vishal Publication, 1986.	
Reference Books	1. M.W. Zemansky, and R.H. Dittman, Heat and Thermodynamics. New York: McGraw-Hill, 1996. 2. S Lokanathan.andR. S. Gambhir, Statistical and Thermal Physics. New Delhi: Prentice Hall, 1991.	