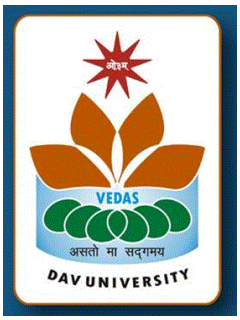
DAV UNIVERSITY



Course Scheme & Syllabus

for

B.Tech. Computer Science Engineering with specialization in SAP

(As per NEP-2020)

1st TO 8thSEMESTER
Examinations 2024–2025 Session

Syllabi Applicable For Admissions in 2024

With the continuous growth of the digital industry, the opportunity to learn with tech giants such as SAP allows students to develop unique skillsets in the most essential aspects of the industry. The program allows student to gain an exposure to the most fundamental areas of the industry with SAP and a global certification which enhances the employability of students.

PROGRAMME EDUCATIONAL OBJECTIVES (PEO's)

PEO1: To provide graduates with the proficiency to utilize new paradigms, dynamics and tools to stay ahead of the curve in creating effective solutions.
PEO2: To prepare graduates for lucrative careers that will enable them to meet the diversified needs of industry and academia.
PEO3: To create and produce software and application systems that provide efficient digital solutions across different industries and to ensure that the students are proficient in the development of SAP based applications.
PEO4: Achieve professional success through the program's emphasis on experiential learning through solving real world problems

PROGRAMME OUTCOMES (POs)

After the successful completion of undergraduate course, Computer Science & Engineering, graduates will be able to:
PO1: Engineering knowledge: Apply the knowledge of mathematics, science, engineering fundamentals, and an engineering specialization to the solution of complex engineering problems.
PO2: Problem analysis: Identify, formulate, review research literature, and analyse complex engineering problems reaching substantiated conclusions using first principles of mathematics, natural sciences, and engineering sciences.
PO3: Design/development of solutions: Design solutions for complex engineering problems and design system components or processes that meet the specified needs with appropriate consideration for the public health and safety, and the cultural, societal, and environmental considerations.
PO4: Conduct investigations of complex problems: Use research-based knowledge and research methods including design of experiments, analysis and interpretation of data, and synthesis of the information to provide valid conclusions.
PO5: Modern tool usage: 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.
PO6: The engineer and society: Apply reasoning informed by the contextual knowledge to assess societal, health, safety, legal and cultural issues and the consequent responsibilities relevant to the professional engineering practice.
PO7: Environment and sustainability: Understand the impact of the professional engineering solutions in societal and environmental contexts, and demonstrate the knowledge of, and need for sustainable development.
PO8: Ethics: Apply ethical principles and commit to professional ethics and responsibilities and norms of the engineering practice.
PO9: Individual and team work: Function effectively as an individual, and as a member or leader in diverse teams, and in multidisciplinary settings.

PO10: Communication: 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.

PO11: Project management and finance: 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.

PO12: Life-long learning: 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.

PROGRAMME SPECIFIC OUTCOMES (PSO's)

PSO1: By learning the latest SAP technologies and solutions through the program, individuals can keep themselves up-to-date. This programme not only earns personal recognition but helps in career advancement from proficiency to mastery.

PSO2: Gain a competitive edge in the job market by building SAP software skills and getting certified on the latest SAP technologies.

Code	Definitions
L	Lecture
T	Tutorial
P	Practical
HS Courses	Humanities & Social Science
BS	Basic Science Courses
ES	Engineering Science Courses
PC	Program Core Courses
PE	Program Elective Courses
OE	Open Elective Courses
EEC	Employment Enhancement Courses (Project/Summer Internship/Seminar)
AEC-C	Ability Enhancement Course-Common
VAC-C	Value Added Course-Common

Mapping of PEO with PO

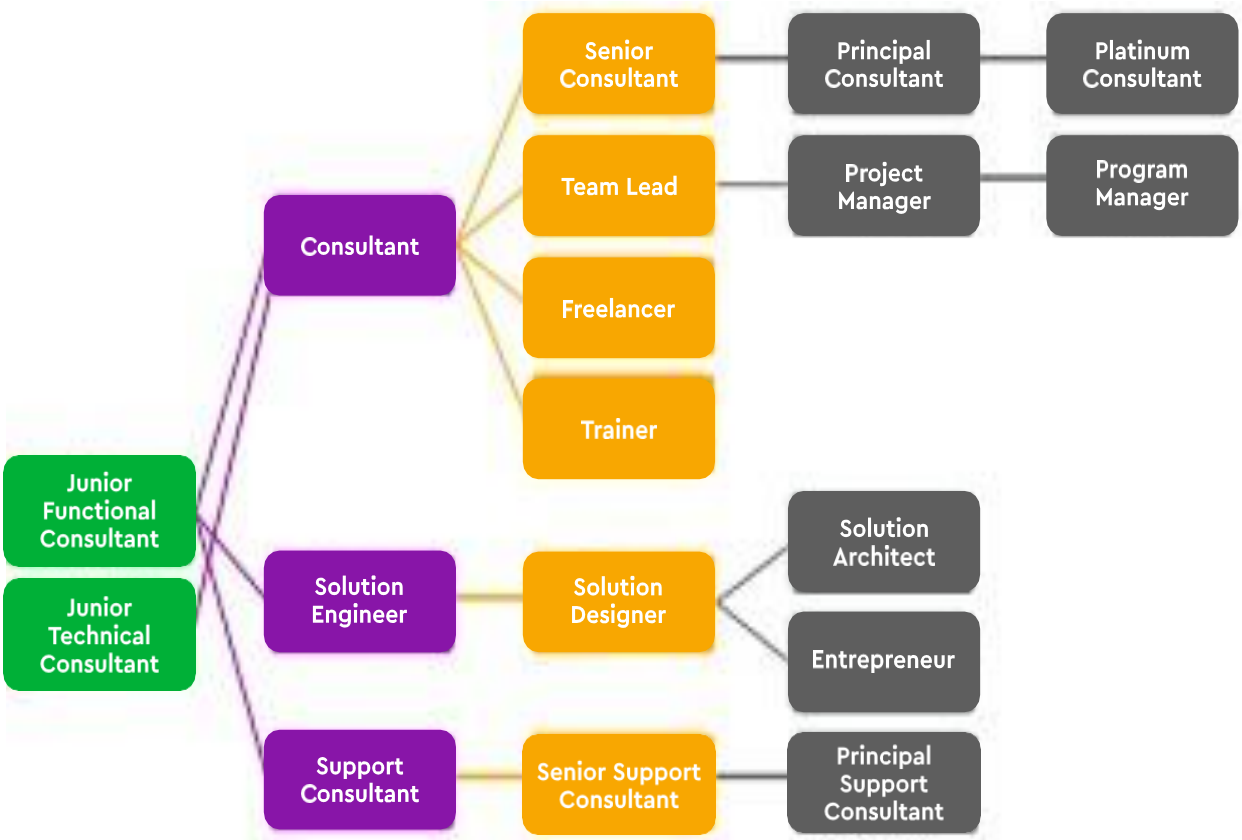
POs \ PEOs	PEO1	PEO2	PEO3	PEO4
PO1	-	-	Y	Y
PO2	Y	Y	-	-
PO3	Y	Y	Y	Y
PO4	Y		Y	Y
PO5	Y	-	Y	Y
PO6	-	Y	Y	Y
PO7	-	Y	-	-
PO8	-	-	Y	Y
PO9	Y	Y	Y	Y
PO10	Y	-	Y	Y
PO11	-	Y	Y	Y
PO12	Y	-	Y	Y

Mapping of PEO with PSO

PEOs \ PSOs	PSO1	PSO2
PEO1	Y	Y
PEO2	Y	Y
PEO3	Y	Y
PEO4	Y	Y

SAP Consultant as the Strongest Career

Career Roadmap for a SAP Consultant



SAP in B.Tech:

Campus to Corporate Program Improving Employability

Academic Year	First Year	Second Year	Third Year
Modules	Business Process Course & OOPS for ABAP	SAP ABAP	SAP ABAP on HANA
Cloud Learning Content	Learning HUB	Learning HUB	Learning HUB
ILT– Classroom Training	160 Hrs	160 Hrs	160 Hrs
Live Server Access	160 Hrs	160 Hrs	160 Hrs
SAP New Technologies	40 Hrs	40 Hrs	40 Hrs
Certification	Course Completion Certificate	1 SAP Global Certification (ABAP)	1 SAP Global Certification (S/4 HANA)

Sl no.	Course	Internship Type	Duration
1	BTech	Paid/Non-Paid	1 Year
2	MBA	Paid/Non-Paid	6 Months
3	MCA	Paid/Non-Paid	6 Months

Internship Value

- Strong knowledge on SAP Technologies
- Opportunity to work on SAP Projects
- Gain Work related experience
- Competitive Advantage in the Job Market
- Networking with the Professionals in the field
- Practical skills for Project Implementation
- Financial compensation

Scheme of Courses
B.Tech. Computer Science & Engineering with specialization in SAP
Semester-1

S.NO.	Course Code	Course Title	L	T	P	Cr	Nature of Course	Academic Delivery By
1.	MAT151	Engineering Mathematics –I	3	1	0	4	BS	DAVU- Faculty
2.	PHS151	Engineering Physics	3	0	2	4	BS	DAVU- Faculty
3.	CST105	Integrated Business Processes in Cloud ERP I	2	0	2	3	PC	SAP- Faculty
4.	EED101	Basic Electrical Engineering	3	0	0	3	ES	DAVU- Faculty
5.	EED102	Practical Fundamental of Electrical Engineering	0	0	2	1	ES	DAVU- Faculty
6.	MED101	Engineering Graphics and Design	0	0	6	3	ES	DAVU- Faculty
7.	MED103	Design Thinking and Idea Lab	0	0	2	1	ES	DAVU- Faculty
8.	HVE101	Human Value & Ethics	2	1	0	3	VAC- C	DAVU- Faculty
9.	ENH111	Cambridge English-I	1	0	2	2	AEC-C	DAVU- Faculty
						24		

L: Lectures T: Tutorial P: Practical Cr: Credits

Scheme of Courses
B.Tech. Computer Science & Engineering with specialization in SAP
Semester-2

S.NO.	Course Code	Course Title	L	T	P	Cr	Nature of Course	Academic Delivery By
1.	MAT152	Engineering Mathematics-II	3	1	0	4	BS	DAVU- Faculty
2.	CHM151	Chemistry	3	0	2	4	BS	DAVU- Faculty
3.	MED102	Manufacturing Practices	0	0	4	2	ES	DAVU- Faculty
4.	CST110	Integrated Business Processes in Cloud ERP II	2	0	2	3	PC	SAP- Faculty
5.	EVS104	Environmental Studies	2	0	2	3	VAC -C	DAVU- Faculty
6.	ENH 112	Cambridge English-II	1	0	2	2	AEC-C	DAVU- Faculty
		Total Credits				**18**		

L: Lectures T: Tutorial P: Practical Cr: Credits

Scheme of Courses
B.Tech. Computer Science & Engineering with specialization in SAP
Semester-3

S.NO.	Course Code	Course Title	L	T	P	Cr	Nature of Course	Academic Delivery By
1.	CST205	Data Structures	3	0	2	4	PC	DAVU- Faculty
2.	CST209	Discrete Mathematics	3	0	0	3	PC	DAVU- Faculty
3.	CST211	Introduction to Artificial Intelligence	3	0	0	3	PC	DAVU- Faculty
4.	CST213	Basic ABAP Programming	1	0	2	2	PC	SAP- Faculty
5.	CST215	Intermediate ABAP Programming	2	0	2	3	PC	SAP- Faculty
6.	CST207	Digital Electronics	3	0	2	4	PC	DAVU- Faculty
7.	CECXXX	Community Engagement Course	1	0	2	2	AEC-C	DAVU- Faculty
		Total Credits				**21**		

L: Lectures T: Tutorial P: Practical Cr: Credits

Scheme of Courses
B.Tech. Computer Science & Engineering with specialization in SAP
Semester-4

S.NO.	Course Code	Course Title	L	T	P	Cr	Nature of Course	Academic Delivery By
1.	CST214	Data modelling in ABAP dictionary and ABAP CDS	1	0	2	2	PC	SAP- Faculty
2.	CST216	Transactional Apps with ABAP RESTFUL application programming model	1	0	2	2	PC	SAP- Faculty
3.	CST218	Introduction to application programming in SAP HANA	1	0	2	2	PC	SAP- Faculty
4.	CST206	Operating System Concepts	3	0	2	4	PC	DAVU- Faculty
5.	CST204	Data Communication and Networking	3	0	2	4	PC	DAVU- Faculty
6.	CST208	Database Management System	3	0	2	4	PC	DAVU- Faculty
		Total Credits				**18**		

L: Lectures T: Tutorial P: Practical Cr: Credits

Scheme of Courses
B.Tech. Computer Science & Engineering with specialization in SAP
Semester-5

S.NO.	Course Code	Course Title	L	T	P	Cr	Nature of Course	Academic Delivery By
1.	CST301	Cryptography and Network Security	3	0	2	4	PC	DAVU- Faculty
2.	CST315	SAP Fiori – Foundation	2	0	2	3	PC	SAP- Faculty
3.	CST317	Developing UIs with SAP UI5	1	0	2	2	PC	SAP- Faculty
4.	CST307	Algorithm Design & Analysis	3	0	2	4	PC	DAVU- Faculty
5.	CST305	Software Engineering	3	0	0	3	PC	DAVU- Faculty
6.	CST303	Data Mining & Warehousing	3	0	2	4	PC	DAVU- Faculty
		Total Credits				**20**		

L: Lectures T: Tutorial P: Practical Cr: Credits

Scheme of Courses
B.Tech. Computer Science & Engineering with specialization in SAP
Semester-6

S.NO.	Course Code	Course Title	L	T	P	Cr	Nature of Course	Academic Delivery By
1.	CST340	Advanced SAP UI5 Development	2	0	2	3	PC	SAP- Faculty
2.	CST342	SAP Fiori Elements Development	1	0	2	2	PC	SAP- Faculty
3.	CST344	Developing SAP Fiori UIs	2	0	2	3	PC	SAP- Faculty
4.	CST304	Big Data Analytics	3	0	0	3	PC	DAVU- Faculty
5.	CST316	Machine Learning	3	0	0	3	PC	DAVU- Faculty
6.	CST322	New Age Technologies	3	0	0	3	PC	DAVU- Faculty
7.	CST3XX	Program Elective-I	3	0	0	3	PE	DAVU- Faculty
		Total Credits				**20**		

L: Lectures T: Tutorial P: Practical Cr: Credits

Scheme of Courses
B.Tech. Computer Science & Engineering with specialization in SAP
Semester-7

S.NO.	Course Code	Course Title	L	T	P	Cr	Nature of Course	Academic Delivery By
1.		Industrial Internship (Industrial Training Report and Viva-voce)	0	0	0	16	EEC	Industry
2.		MOOC Courses(Open Elective-I)	3	1	0	4	OE	
						20		

L: Lectures T: Tutorial P: Practical Cr: Credits

Scheme of Courses
B.Tech. Computer Science & Engineering with specialization in SAP
Semester-8

S.NO.	Course Code	Course Title	L	T	P	Cr	Nature of Course	Academic Delivery By
1.		Capstone Project	0	0	0	12	EEC	Industry
2.		Industrial Training Report and Viva-voce	0	0	0	5	EEC	Industry
3.		MOOC Courses(Open Elective-II)	3	0	0	3	OE	
						20		

L: Lectures T: Tutorial P: Practical Cr: Credits

Program Elective-I

S.NO.	Course Code	Course Title	L	T	P	Cr	Nature of Course
1.	CST320	Software Project Management	3	0	0	3	PE
2.	CST328	Cognitive Computing	3	0	0	3	PE
3.	CST334	R for Data Science	3	0	0	3	PE
4.	CST324	Digitizing Industry Knowledge for Software Development	3	0	0	3	PE

B Tech CSE with specialization in SAP
Course Structure

CBCS	Nature of Courses	Core	Elective Courses			Ability Enhancement Courses		Total Credits
Year	Course Structure	Core	Dissertation/ Project(EEC)	Open Elective/ MOOC Courses	Program Elective/ MOOC Courses	Ability Enhancement Compulsory Courses	Value Added Courses	
2024	B Tech CSE with SAP	106	33	7	3	6	6	161

Core	Basic Sciences (BS) including Mathematics, Physics, Chemistry, Biology	Engineering Sciences (ES) including Materials, WS, ED, Basics of EE/ME/CSE	Discipline Core	Total Credits
106	16	10	80	106

In hours			
L	**T**	**P**	**Credit**
3	1	0	4

Course Code	**MAT151**						
Course Title	**Engineering Mathematics-I**						
Course Outcomes	On the completion of the course, the student will gain the following knowledge and skills: CO1: Understand the theory of matrices used in solving the problems in mechanics and other streams. CO2: Understand the concept of partial differentiation, Euler's theorem and its extension, total derivative, maxima and minima of a function of two variables, and Lagrange's method of multipliers. CO3: Understand the concept of ordinary differential equation and their solutions (Homogeneous, differential equation, Exact differential equations). CO4: Understand the solution of differential equations with constant coefficients by method of variation of parameters and simultaneous linear differential equations.						
Examination Type	Theory						
Assessment Tools	Written Quiz	Assignment/Project Work	MSE	MSP	ESE	ESP	Attendance
Weightage	**10**	**10**	**25**	**0**	**50**		**5**
Examination Mode	Theory						
Syllabus	**Unit 1: (11 hours)** Rank of matrices, Inverse of Matrices, Gauss Jordan Method, reduction to normal form, Consistency and solution of linear algebraic system of equations, Gauss Elimination Method, Eigen values and Eigen vectors, Diagonalisation of Matrix, Cayley Hamilton theorem. Orthogonal, Hermition and unitary matrices.						**CO1**
	Unit 2: (13 hours) Concept of limit and continuity of a function of two variables, Partial derivatives, Homogenous Function , Euler's Theorem Total Derivative, Differentiation of an implicit function, chain rule Change of variables, Jacobian, Taylor's and McLaurin's series, Maxima and minima of a function of two and three variables: Lagrange's method of multipliers.						**CO2**
	Unit 3: (13 hours) Formation of ordinary differential equations, solution of first order differential equations by separation of variables Homogeneous equations, Reduce to Homogenous Exact differential equations, equations reducible to exact form by integrating factors Equations of the first order and higher degree, clairaut's equation.						**CO3**

	Unit 4: (11 hours) Solution of differential equations with constant coefficients Method of differential operators. Homogeneous equations of second order with constant coefficients: Solution by method of variation of parameters Simultaneously Linear differential equation	**CO4**
Reference Books:	1. Grewal, B.S. Higher Engineering Mathematics. New Delhi: Khanna Publication, 2009. 2. Jain, R K, and K Iyengar S R. Advanced Engineering Mathematics, New Delhi: Narosa Publishing House, 2003.Artificial Intelligence by Rich and Knight, The McGraw Hill, 2017. 3. Kreyszig, Erwin. Advanced Engineering Mathematics. New Delhi: Wiley Eastern Ltd., 2003. **4.** Thomas, George B. and Finney Ross L. Calculus and Analytic Geometry. New Delhi Addison Wesley, 1995.	

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

Course Code	**PHS151**						
Course Title	**Engineering Physics**						
Course Outcomes	On the completion of the course, the student will gain the following knowledge and skills: CO1: To generate Knowledge of wave optics with particular emphasize on interference, diffraction, polarization CO2: To enhance understanding LASER, its working mechanism and various types. Knowledge of fiber optics CO3: To create cognizance of superconductivity, Quantum Physics and Nanophysics CO4: To make students cover the bridge between theory and practical by analysing the obtained data.						
Examination Type	Theory + Practical(30hrs)						
Assessment Tools	Written Quiz	Assignment/Project Work	MSE	MSP	ESE	ESP	ATTENDANCE
Weightage	**10**		**25**	**0**	**35**	**25**	**5**
Examination Mode	Theory + Practical						
Syllabus	**Unit 1: (11 hours)** **Interference:** Division of wave front, Fresnel's biprism, division of amplitude, Newton's rings and applications **Diffraction:** Difference between Fraunhofer and Fresnel diffraction, Fraunhofer diffraction through a slit, plane transmission diffraction grating, its dispersive and resolving power **Polarization:** Polarized and unpolarised light, double refraction, Nicol prism, quarter and half wave plates.						**CO1**
	Unit 2: (11 hours) LASER: Spontaneous and stimulated emission, Laser action, Characteristics of laser beam, concept of coherence, He-Ne laser, Semiconductor laser, Ruby laser and applications, Holography FIBRE OPTICS: Propagation of light in fibers, numerical aperture, single mode and multimode fibers, applications						**CO2**

	Unit 3: (11 hours) Difficulties with Classical physics, Introduction to quantum mechanics, Black Body radiation, Planck's Law of radiation, Photo electric effect , Wave particle duality, Heisenberg uncertainty principle, Time dependent and Time independent Schrodinger's wave equation concept of wave function. Introduction to Nano science and Nanotechnology, Electron confinement, Nanomaterial, Nanoparticles, Quantum structure, CNT, Synthesis of Nanomaterial and Application of Nanomaterial. Introduction (experimental survey), Meissner effect, Type I and type II superconductors, London equation, Elements of BCS theory, Applications of superconductors	**CO3**
	Unit 4: (12 hours) **Experimental skills:** General Precautions for measurements and handling of equipment, representation of measurements, Fitting of given data to a straight line, and Error analysis, Significant figures and interpretation of results. 1. To determine wavelength of sodium light using Newton's Rings. 2. Study of Solar Cell characteristics. 3. To compare the focal length of two lenses by Nodal slide method. 4. To determine the beam divergence of the He-Ne laser. 5. To compare the two unknown capacitances of two capacitors by using De Sauty's bridge. 6. To find our out the unknown inductance by using the Anderson's bridge method. 7. To determine the Refractive Index of the Material of a given Prism using Sodium Light. 8. Determination of Plank's constant using photoelectric effect. 9. To study the capacitance by flashing/quenching of Neon bulb kit. To study the specific rotation of sugar solution Laurent's half shade Polari meter method.	**CO4**
Reference Books:	1. Beiser, A. Perspective of Modern Physics. New Delhi: McGraw Hill Ltd., 2002 2. Verm, N.K Physics for Engineers. New Delhi: Prentice Hall., 2014. 3. Malik,H.K and Singh, A.K. Engineering Physics. New Delhi: McGraw Hill Ltd., 2017(second edition). 4. Sear, F.W. Electricity and Magnetism. London: Addison-Wesley, 1962 5. Resnick and Halliday. Physics.New York: Wiley, 2002. 6. Jenkins, and White. Fundamental of Physical Optics. New York: Tata McGraw-Hill, 1937	

In hours			
L	T	P	Credit
3	0	0	3

Course Code	**EED101**						
Course Title	**Basic Electrical Engineering**						
Course Outcomes	On the completion of the course, the student will gain the following knowledge and skills: CO1: Apply the knowledge of Electrical Engineering principles to solve DC and AC circuits. CO2: Formulate and analyse electrical circuits. Understand basic principles of electromagnetism CO3: Understand electrical machines and transformers CO4: Identify and select various electrical machines according to the applications. CO5: Apply the ethical principles for troubleshooting & installation of safety devices as per norms.						
Examination Type	Theory						
Assessment Tools	Written Quiz	Assignment/Project Work	MSE	MSP	ESE	ESP	ATTENDANCE
Weightage	**10**	**10**	**25**	**0**	**50**	**0**	**5**
Examination Mode	Theory						
Syllabus	Unit 1: (11 hours) **D.C Circuit Analysis:** Voltage source, current source, dependent and independent sources, analysis of D.C circuit by KCL and KVL , Nodal and Mesh analysis, Superposition theorem, Maximum Power Transfer Theorem, Thevenin and Norton Theorems						CO1
	Unit 2: (12 hours) **A.C Circuit Analysis:** Review of single phase A.C. circuit under sinusoidal steady state, RMS Value, Average Value, Form factor, Peak factor solution of RL, RC, R.L.C. Series circuit, the j operator, complex representation of impedance, solution of series circuit, series resonance, 3 phase A.C. Circuit, star and delta connections, line and phase quantities solution of 3 phase circuits, balance supply voltage and balanced supply voltage and balance load, Phasor diagram, measurement of power and power factor.						CO2
	Unit 3: (12 hours) **Magnetic Circuit & Transformers:** H Curve, saturation leakage and fringing. Hysteresis and eddy currents.Single phase transformer, basic concepts constructional, voltage, current Transformation, Ideal transformer and its Phasor diagram, voltage regulation, OC/SC test, losses and efficiency, Autotransformer.						CO3

	Unit 4: (12 hours) **Rotating Electrical Machines:** Basic concepts, working principle and general construction of DC machines (motor/generators), torque and EMF expression. Generation of rotating magnetic fields, Construction and working of a three-phase induction motor, Significance of torque-slip characteristic. Loss components and efficiency, starting and speed control of induction motor. **Electrical Installations** Components of LT Switchgear: Switch Fuse Unit (SFU), MCB, ELCB, MCCB, Types of Wires and Cables, Earthing. Types of Batteries, Important Characteristics for Batteries. Various faults in Battries, Elementary calculations for energy consumption, power factor improvement and battery backup.	CO4
Reference Books:	1. M.S. Sukhija, T.K. Nagsarkar, "Basic Electrical and Electronics Engineering", Oxford University Press, 2012. 2. Ashfaq Husain, HarsoonAshfaq, " Fundamentals of Electrical Engineering, 4th Edition, DhanpatRai and Co., 2013 3. V.N. Mittle, "Basic Electrical Engineering", 2nd Edition, Tata McGraw Hill Publication. 4. B.L. Theraja, A.K. Theraja, " A Text Book of Electrical Technology, Volume-1, S. Chand Publication 5. Debashisha Jena, "Basic Electrical Engineering", 1st edition, Wiley India Publication, 2012. 6. B.L. Theraja, R.S. Sedha, " Principles of Electric Devices and Circuits", S. Chand Publication, 1st edition, 2006	

In hours			
L	**T**	**P**	**Credit**
0	0	2	1

Course Code	**EED102**						
Course Title	**Electrical Engineering Laboratory**						
Course Outcomes							
Examination Type	Practical						
Assessment Tools	Written Quiz	Assignment/Project Work	MSE	MSP	ESE	ESP	ATTENDANCE
Weightage	**10**	**10**	**25**	**0**	**50**	**0**	**5**
Examination Mode	Practical						
Syllabus							CO1
							CO2
							CO3
							CO4

Course Code	**PHS151**						
Course Title	**Engineering Physics**						
Course Outcomes	On the completion of the course, the student will gain the following knowledge and skills: CO1: To generate Knowledge of wave optics with particular emphasize on interference, diffraction, polarization CO2: To enhance understanding LASER, its working mechanism and various types. Knowledge of fiber optics CO3: To create cognizance of superconductivity, Quantum Physics and Nanophysics CO4: To make students cover the bridge between theory and practical by analysing the obtained data.						
Examination Type	Theory + Practical(30hrs)						
Assessment Tools	Written Quiz	Assignment/Project Work	MSE	MSP	ESE	ESP	ATTENDANCE
Weightage	**10**		**25**	**0**	**35**	**25**	**5**
Examination Mode	Theory + Practical						
Syllabus	**Unit 1: (11 hours)** **Interference:** Division of wave front, Fresnel's biprism, division of amplitude, Newton's rings and applications **Diffraction:** Difference between Fraunhofer and Fresnel diffraction, Fraunhofer diffraction through a slit, plane transmission diffraction grating, its dispersive and resolving power **Polarization:** Polarized and unpolarised light, double refraction, Nicol prism, quarter and half wave plates.						**CO1**
	Unit 2: (11 hours) LASER: Spontaneous and stimulated emission, Laser action, Characteristics of laser beam, concept of coherence, He-Ne laser, Semiconductor laser, Ruby laser and applications, Holography FIBRE OPTICS: Propagation of light in fibers, numerical aperture, single mode and multimode fibers, applications						**CO2**

	Unit 3: (11 hours) Difficulties with Classical physics, Introduction to quantum mechanics, Black Body radiation, Planck's Law of radiation, Photo electric effect , Wave particle duality, Heisenberg uncertainty principle, Time dependent and Time independent Schrodinger's wave equation concept of wave function. Introduction to Nano science and Nanotechnology, Electron confinement, Nanomaterial, Nanoparticles, Quantum structure, CNT, Synthesis of Nanomaterial and Application of Nanomaterial. Introduction (experimental survey), Meissner effect, Type I and type II superconductors, London equation, Elements of BCS theory, Applications of superconductors	**CO3**
	Unit 4: (12 hours) **Experimental skills:** General Precautions for measurements and handling of equipment, representation of measurements, Fitting of given data to a straight line, and Error analysis, Significant figures and interpretation of results. 10. To determine wavelength of sodium light using Newton's Rings. 11. Study of Solar Cell characteristics. 12. To compare the focal length of two lenses by Nodal slide method. 13. To determine the beam divergence of the He-Ne laser. 14. To compare the two unknown capacitances of two capacitors by using De Sauty's bridge. 15. To find our out the unknown inductance by using the Anderson's bridge method. 16. To determine the Refractive Index of the Material of a given Prism using Sodium Light. 17. Determination of Plank's constant using photoelectric effect. 18. To study the capacitance by flashing/quenching of Neon bulb kit. To study the specific rotation of sugar solution Laurent's half shade Polari meter method.	**CO4**
Reference Books:	7. Beiser, A. Perspective of Modern Physics. New Delhi: McGraw Hill Ltd., 2002 8. Verm, N.K Physics for Engineers. New Delhi: Prentice Hall., 2014. 9. Malik,H.K and Singh, A.K. Engineering Physics. New Delhi: McGraw Hill Ltd., 2017(second edition). 10. Sear, F.W. Electricity and Magnetism. London: Addison-Wesley, 1962 11. Resnick and Halliday. Physics.New York: Wiley, 2002. 12. Jenkins, and White. Fundamental of Physical Optics. New York: Tata McGraw-Hill, 1937	

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

Course Code	**CST105**								
Course Title	**Integrated Business Processes in Cloud ERP I**								
Course Outcomes									
Examination Mode	Theory + Practical								
Assessment Tools	Continuous Assessment(CA)				MSE	MSP	ESE	ESP	Total
	Quiz	Assignment / Project Work	Attendance	Lab Performance					
Weightage	-	-	-	20	-	30	-	50	100
Syllabus									**CO Mapping**

In hours			
L	**T**	**P**	**Credit**
2	1	0	3

Course Code	HVE101						
Course Title	**Human Values and Ethics**						
Course Outcomes	On the completion of the course, the student will gain the following knowledge and skills: CO1: Development of a holistic perspective based on self – exploration about themselves (human being), family, society and nature/existence. CO2: Understanding (or developing clarity) of the harmony in the human being, family, society and nature/existence CO3: Strengthening of self-reflection. CO4: Development of commitment and courage to act.						
Examination Type	Theory + Practical						
Assessment Tools	Written Quiz	Assignment/Project Work	MSE	MSP	ESE	ESP	Attendance
Weightage	**10**	**10**	**25**		**50**		**5**
Examination Mode	Theory + Practical						
Syllabus	Unit 1: **Course Introduction - Need, Basic Guidelines, Content and Processfor Value Education and Understanding Harmony in the Human Being – Harmony in Myself!** Purpose and motivation for the course, recapitulation from Universal Human 1 Values -1, Self – Exploration – what is it? – its content and process; 'Natural Acceptance' and Experiential Validation – as theprocess for self –exploration.Continuous Happiness and Prosperity – A look at basic Human Aspirations. Right understanding, Relationship and Physical Facility – the basic requirements for fulfilment of aspirations of every human being with their correct priority. Understanding the needs of Self ('I') and 'Body' – happiness and physical facility. Understanding the characteristics and activities of 'I' and harmony in 'I'. Understanding the harmony of I with the Body : Sanyam and Health;correct appraisal of Physical needs, meaning of Prosperity in detail.						CO1
	Unit 2: (14 hours) **Understanding Harmony in the Family and Society – Harmony in Human – Human Relationship**: 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.						CO2

	Understanding the detailed meaning of Trust and Respect: Difference between intention and competence, Understanding the meaning of Respect, Difference between respect and differentiation; the other salient values in relationship. Understanding the harmony in the society (society being an extension Of family): Resolution, Prosperity, fearlessness (trust) and co – existence as comprehensive Human Goals.	
	Unit 3: (14 hours) **Understanding Harmony in the Nature and Existence – Whole existence as Coexistence** Understanding the harmony in the Nature. Understanding Existence as Co – existence of mutually interacting unitsin all- pervasive space. Holistic perception of harmony at all levels of existence. 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.	CO3
	Unit 4: (12 hours) **Implications of the above Holistic Understanding of Harmony on Professional Ethics** Basis for Humanistic Education, Humanistic Constitution and Humanistic Universal Order Competence in professional ethics : a. Ability to utilize the professional for 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. Case studies of typical holistic technologies, management models and production systems.	CO4
Reference Books:	1. A Nagaraj, Jeeban Vidya: Ek Parichaya. Jeevan Vidya Prakashan, Amarkantak, 1999. 2. A.N. Tripathi, Human Values. New Age Intl. Publishers, New Delhi,2004. 3. Annie Leonard, The Story of Stuff . Free Press, Mumbai, latest edition. 4. Mohandas Karamchand Gandhi, The Story of My Experiments with Truth. Fingerprint publisher, New Delhi,latest edition. 5. E. F Schumacher, Small is Beautiful . Blond & Briggs and HarperCollins, latest edition. 6. Cecile Andrews , Slow is Beautiful. New Society publishers, Canada, latest edition. 7. J C Kumarappa , Economy of Permanence. Sarva Seva Sangh Prakashan, Varanasi, latest edition. 8. Pandit Sunderlal, Bharat Mein Angreji Raj . Prabhat Prakashan, New Delhi, latest edition. 9. Dharampal, Rediscovering India. Biblia Impex, New Delhi, latest edition. 10. Mohandas K. Gandhi, Hind, Swaraj or Indian Home Rule . The International Printing Press Phoenix, Natal, latest edition.	

	11. Maulana Abdul Kalam Azad, India Wins Freedom. Orient Blackswan, Hyderabad, latest edition. 12. Romain Rolland , Life of Vivekananda. Advaita Ashrama, Kolkata, Latest Edition. 13. Romain Rolland, Mahatma Gandhi. Srishti Publishers & Distributors, New Delhi, Latest Edition.	

In hours			
L	T	P	Credit
2	1	0	3

Course Code	**ENH111**						
Course Title	**Cambridge English I**						
Course Outcomes	On the completion of the course the student will be able to CO1: Develop effective listening skills to comprehend spoken English in various contexts and accents, employing strategies such as skimming, scanning, and understanding implicit meaning. CO2: Improve spoken communication skills by expressing ideas fluently, engaging in discussions, role-plays, and collaborative tasks, and applying effective communication strategies. CO3: Enhance reading comprehension abilities to understand and interpret diverse written materials using techniques like skimming, scanning, and critical reading to extract essential information. CO4: Develop writing proficiency to produce well-structured, coherent written pieces, demonstrating accurate grammar usage, vocabulary selection, and effective organization.						
Examination Mode	Theory + Practical						
Assessment Tools	Written Quiz	Assignment/Project Work	MSE	MSP	ESE	ESP	Attendance
Weightage	**10**			**20**	**35**	**30**	**5**
Examination Mode	Theory + Practical						
Syllabus							CO Mapping
Unit 1	**Chapters 1-4**						
	Listening: Introduction to Listening I Listening to people talk about their past, Listening to a description of a transportation system, Listening to people talk about capsule hotels, etc. **Speaking: Basic Conversation Skills I** Introducing yourself; Talking about yourself; Exchanging personal information; Talking about transportation and transportation problems; Evaluating city services; Asking for and giving information; describing positive and negative features; Making comparisons; Expressing wishes; talking about food; Giving step-by-step instructions, etc. **Reading: Introduction to Reading Skills and Comprehension Strategies I** Reading about the life of a Mexican painter, Reading about the happiest cities in the world, Reading about living without money, Reading about the history of pizza, etc **Writing: Introduction to Basics of Writing I** Writing a paragraph about your childhood, Writing an online post on a community message board about a local issue, Writing an email comparing two living spaces, etc **Grammar: An Introduction to the Fundamentals of English Grammar I** Past tense; *used to* for habitual actions, Expressions of quantity with count and noncount nouns: *too many*, *too much*, *fewer*, *less*, *more*, *not enough*; indirect questions from Wh-questions,						CO1 CO2 CO3 CO4 CO4

	Evaluations and comparisons with adjectives: *not . . . enough*, *too*, *(not) as . . . as*; evaluations and comparisons with nouns: *not enough . . .* , *too much/many . . .* , *(not) as much/many . . . as*; *wish.*	
	Self-paced practice with Online Workbook (Units 1-4)	
Unit 2	***Chapters 5-8***	
	Listening: Listening For Basic Information Listening to travel advice, Listening to the results of a survey about family life, Listening to a radio program, listening to people give suggestions for using technology, Listening to a description of Carnival in Brazil, etc. **Speaking: Vocabulary Development for Effective Conversation** Speaking about vacation plans; giving travel advice; planning a vacation, Making requests; agreeing to and refusing requests; complaining; apologizing; giving excuses, giving instructions; giving suggestions, Talking about holidays, festivals, customs, and special events, etc. **Reading: Introduction to Reading Skills and Comprehension Strategies II** Reading about unusual vacations, Reading about unusual hotel requests, Reading about sharing economy, Reading about interesting New Year's customs, etc. **Writing: Introduction to Basics of Writing II** Writing a message making a request, Writing a message asking for specific favors, and Writing an entry on a travel website about a cultural custom, etc. **Grammar: An Introduction to the Fundamentals of English Grammar II** Future with *be going to* and *will*; modals for necessity and suggestion: *must*, *need to*, *(don't) have to*, *ought to*, *-'d better*, *should (not),* Two-part verbs; *will* for responding to requests; requests with modals and *Would you mind . . . ?,* Infinitives and gerunds for uses and purposes; imperatives and infinitives for giving suggestions,	CO1 CO2 CO3 CO4 CO4
	Self-paced practice with Online Workbook (Units 5-8)	
Unit 3	***Chapters 9-12***	

	Listening: Listening for Specific Information Listening to people talk about changes, Listening to people talk about their job preferences, Listening to descriptions of monuments, listening for information about a country, Listening to stories about unexpected experiences, etc. **Speaking: Descriptive Speaking I** Talking about change; comparing time periods; describing possible consequences; describing abilities and skills; describing personality traits; talking about landmarks and monuments; describing countries; discussing facts, Describing recent past events and experiences, etc **Reading: Introduction to Reading Skills and Comprehension Strategies III** Reading about a town's attempt to attract new residents, Reading about understanding cultural differences in an international company, Reading about unusual museums, Reading about an unusual rock band, etc **Writing: Introduction to Basics of Writing III** Writing a paragraph describing a person's past, present, and possible future, Writing an online cover letter for a job application, Writing an introduction to an online city guide, Writing a description of a recent experience **Grammar: An Introduction to the Fundamentals of English Grammar III** Time contrasts; conditional sentences with *if* clauses, Gerunds; short responses; clauses with *because,* Passive with *by* (simple past); passive without *by* (simple present); past continuous vs. simple past; present perfect continuous.	CO1 CO2 CO3 CO4 CO4
	Self-paced practice with Online Workbook (Units 9-12)	
Unit 4	**Chapters 13-16**	

	Listening: Listening for Sequencing Listening for opinions; listening to a movie review; listening to people talk about the meaning of signs, Listening to people talk about predicaments; listening to a call-in radio show, etc. **Speaking: Descriptive Speaking II** Describing movies and books; talking about actors and actresses; asking for and giving reactions and opinions, Interpreting body language; explaining gestures and meanings; Speculating about past and future events; describing a predicament; giving advice and suggestions, Reporting what people said; making polite requests; making invitations and excuses, etc. **Reading: Introduction to Reading Skills and Comprehension Strategies IV** Reading about unpleasant experiences actors put themselves through, Reading about idioms and their meaning, Reading an online advice forum, Reading about taking a sick day, etc **Writing: Introduction to Basics of Writing IV** Writing a movie review, Writing a report about people's responses to a survey, etc **Grammar: An Introduction to the Fundamentals of English Grammar IV** Participles as adjectives; relative pronouns for people and things, Modals and adverbs: *might*, *may*, *could*, *must*, *maybe*, *perhaps*, *probably*, *definitely*; permission, obligation, and prohibition, Unreal conditional sentences with *if* clauses; past modals, Reported speech: requests and statements	CO1 CO2 CO3 CO4 CO4
	Self-paced practice with Online Workbook (Units 13-16	
Text Books	***Interchange Level 2 - 5th edition*** published by Cambridge University Press	

In hours			
L	**T**	**P**	**Credit**
3	1	0	4

Course Code	**MAT152**						
Course Title	**Engineering Mathematics-II**						
Course Outcomes	On the completion of the course the student will be able to CO1: Understand complex numbers and its applications, summation of trigonometric series. CO2: Understand double, triple integration to use in finding areas and volumes of curves. CO3: Understand vector calculus, del, gradient, divergence, and line and surface integrals. CO4: Understand Convergence, divergence, absolute convergence, uniform convergence and different tests to check convergence.						
Examination Type	Theory						
Assessment Tools	Written Quiz	Assignment/Project Work	MSE	MSP	ESE	ESP	Attendance
Weightage	**10**	**10**	**25**	**0**	**50**		**5**
Examination Mode	Theory						
Syllabus	**Unit 1: (11 hours)** **Functions of Complex Variables** Complex Numbers and elementary functions of complex variables.De-Moivre's theorem and its applications. Real and imaginary parts of exponential, logarithmic, circular, inverse circular, hyperbolic, inverse hyperbolic functions of complex variables.Summation of trigonometric series (C+iS method).						**CO1**
	Unit 2: (13 hours) **Integral Calculus** Rectification of standard curves, Areas bounded by standard curves,Volumes and surfaces of revolution of curves. Double and triple integral and their evaluation, change of order of integration, change of variables.Application of double and triple integration to find areas and volumes.Centre of gravity and Moment of inertia.						**CO2**
	Unit 3: (13 hours) **Vector Calculus and its applications** Scalar and vector fields, differentiation of vectors, velocity and acceleration.Del, Gradient, Divergence and Curl, their physical interpretations,Line, surface and volume integrals. Flux, Solenoidal and Irrotational vectors. Gauss Divergence theorem, Green's theorem in plane, Stoke's theorem (without proofs) and their applications.						**CO3**

	Unit 4: (11 hours) **Infinite Series** Convergence and divergence of series, tests of convergence (without proofs): comparison test, Integral test, ratio test. Raabe's test, logarithmic test, Cauchy's root test and Gauss test. Convergence and absolute convergence of alternating series.Uniform Convergence and power Series.	**CO4**
Reference Books:	1. Grewal, B.S. Higher Engineering Mathematics. New Delhi: Khanna Publication, 2009. 2. Jain, R K, and K Iyengar S R. Advanced Engineering Mathematics, New Delhi: Narosa Publishing House, 2003.Artificial Intelligence by Rich and Knight, The McGraw Hill, 2017. 3. Kreyszig, Erwin. Advanced Engineering Mathematics. New Delhi: Wiley Eastern Ltd., 2003. 4. Thomas, George B. and Finney Ross L. Calculus and Analytic Geometry. New Delhi Addison Wesley, 1995.	

In hours			
L	T	P	Credit
3	1	0	4

Course Code	**CHM151**						
Course Title	**Chemistry**						
Course Outcomes	On the completion of the course the student will be able to: CO1: Students will be able to understand the basic concept of spectroscopy (IR, UV, and NMR). CO2: Familiarize with the basic properties of water and its uses in industrial and domestic purposes and understand the basic knowledge about corrosion, their classification, different mechanism and understand the various factors influencing corrosion and various methods of corrosion control. CO3: To provide the basic knowledge about the classification of polymer. Familiarize students with a complete packet of information of mechanism of polymerization, the effect of molecular weight on the properties of polymers, and understand the basic concept of polymer reinforced composites. Understand the concept of chemistry in Nano science and nanotechnology. CO4: Apply the concept of physical properties of liquids, pH and to understand the basic objectives of experiments in engineering chemistry.						
Examination Type	Theory + Practical						
Assessment Tools	Written Quiz	Assignment/Project Work	MSE	MSP	ESE	ESP	Attendance
Weightage	**10**		**25**	**0**	**35**	**25**	**5**
Examination Mode	Theory + Practical						
Syllabus	**Unit 1: (12 hours)** Spectroscopy and its Applications General Introduction: Introduction, electromagnetic spectrum, absorption and emission spectrum, atomic and molecular spectroscopy, types of molecular spectra, experimental techniques, selection rules, width, and intensities of spectral lines. UV/Visible Spectroscopy: types of electronic Transitions, Chromophores, Auxochromes, Effect of conjugation on Chromophores, Factors affecting λmax and intensity of spectral lines, effect of solvent on λmax, isosbestic point, applications. IR Spectroscopy: Infrared region, fundamental modes of vibrations and types, theory of infrared spectra, vibrational frequency and energy levels, modes of vibrations of polyatomic molecules, characteristic signals of IR spectrum, fingerprint region, factors affecting vibrational frequency; applications. NMR Spectroscopy: Principle and instrumentation, proton magnetic resonance spectroscopy, number of signals, Chemical shift.						**CO1**
	Unit 2: (12 hours) Water and its treatment & Corrosion and its Prevention						**CO2**

	Introduction, hardness of water, degree of hardness, units of hardness, boiler feed water: specification, scales, and sludge formation; priming& foaming, boiler corrosion. Treatment of boiler feed water, internal treatment of water; softening of water by lime-soda, zeolite, and ion exchange methods. Introduction; different types of corrosion - wet and dry corrosion; mechanism of wet corrosion; comparison of dry and wet corrosion, Types of electrochemical corrosion. Galvanic corrosion, concentration cell corrosion or differential aeration corrosion, waterline corrosion, pitting corrosion, crevice corrosion, stress corrosion, intergranular corrosion. Passivity, galvanic series, factors influencing corrosion, various methods of corrosion control.	
	Unit 3: (14 hours) Polymers and Reinforce composites Introduction, monomer and repeating unit, degree of polymerization, functionality, and classification of polymers: based on origin, monomers, structure, method of synthesis, tacticity or configuration, action of heat, chemical composition, and ultimate form. Types of polymerization, specific features of polymers, regularity and irregularity, tacticity of polymers. Average molecular weights and size, determination of molecular weight by number average methods, effect of molecular weight on the properties of polymer. Introduction to polymer reinforced composites. Introduction to Nano composites, Materials self-assembly, self-assembling materials, two dimensional assemblies, Nano scale materials, future perspectives applications, nano composites, and its applications.	**CO3**
	Unit 4: (14 hours) **Practical** Preparation of a polymer phenol/urea formaldehyde resin. Determination of surface tension of given liquid by using Stalagmometer. Determination of the viscosity of given lubricating oil by using Redwood Viscometer. Determination of the strength of HCl solution by titrating against NaOH using pH meter. Determine the strength of HCl solution by titrating against NaOH solution conductometerically. Determination of total hardness of water (tap) using standard EDTA solution and Eriochrome black T indicator. Determination of residual chlorine in a water sample. Determination of dissolved oxygen present in given sample of water. Determination of alkalinity of water.	**CO4**
Reference Books:	1. William Kemp, Organic Spectroscopy, Palgrave Foundations, 199	

	2. D. A. Skoog, F. J. Holler and A. N. Timothy, Principle of Instrumental Analysis, 5th Edition., Saunders College Publishing, Philadelphia, 1998. 3. C. P. Poole, Jr., F. J. Owens, Introduction to Nanotechnology, Wiley Interscience, 2003. 4. L.E. Foster, Nanotechnology, Science Innovation & Opportunity, Pearson Education, 2007. 5. P. Ghosh, Polymer Science, and technology (2nd Edition), Tata McGraw Hill, 2008. 6. Wiley Engineering Chemistry, Second Edition, 2013.	

In hours			
L	**T**	**P**	**Credit**
3	1	0	4

Course Code	MED102								
Course Title	**Manufacturing Practice**								
Course Outcomes	On the completion of the course the student will be able to: CO1: To Know basic workshop processes, Read, and interpret job drawing. CO2: Identify, select, and use various marking, measuring, holding, striking, and cutting tools & equipment's CO3: Operate and control different machines and equipment's. CO4: To provide exposure to the students with hands on experience on various basic engineering practices in Civil, Mechanical, Electrical and Electronics Engineering.								
Examination Mode	Practical (48hr)								
Assessment Tools	Continuous Assessment (CA)				MSE	MSP	ESE	ESP	Total
	Quiz	Assignment/ Project Work	Attendance	Lab Performance					
Weightage	-	-	-	20	-	30	-	50	100
Syllabus									**CO Mapping**
Unit 1	***Carpentry Shop and Welding shop***								12hr
	Introduction, Classification of wood, Seasoning of wood, Classification of carpentry tools, Joints and joining processes, Wood working machines and processes, safety precaution, Preparation of half lap joint, Preparation of Mortise and Tenon Joint, Preparation of a Dove & Tail joint, To prepare a White board duster. Introduction, Various welding processes with brief introduction, Electric Arc welding, Arc welding procedure, List of equipment for electric arc welding, Gas welding process and equipment, Preparation of Joint by Arc Welding, Preparation of Joint by using Gas Welding, Preparation of Joint by MIG/ TIG Welding, Preparation of Joint by Spot/ Seam Welding.								CO1
Unit 2	***Fitting shop and Foundry shop***								12hr
	Introduction, Tools used in fitting, measuring and marking tools, the process of making sawing, Filling, Tapping and die, Introduction to drills, Filing a dimensioned rectangular or square piece and prepare a sq. fitting, Preparation of T fitting male part, Preparation of U fitting Female part, Internal thread Cutting in Square piece and external thread cutting on a rod and assembling as a paper weight. Introduction, Basic terminology, Pattern, Types of patterns, Patterns allowances, Tools for hand Moulding, Moulding sand and Moulding process, Crucible furnace, Operation of cupola, Foundry containers, Casting defects, Safety precautions, To make a Mould of solid pattern, To prepare a mould of sleeve fitting using gating system, To make a Mould of Split Pattern using Cope & Drag, To check the Hardness of the Mould.								CO2
Unit 3	***Sheet- Metal Shop and Machine Shop***								12hr

	Introduction, Types of sheets (ferrous/non-ferrous), Standard sheet sizes and their measurement, Tools used in sheet metal. Preparation of a funnel from G.I. sheet, Preparation of a book rack stand from G.I. Sheet, Preparation of a leak proof tray with inclined edges from G.I. Sheet, Preparation of a square pen stand from G.I. Sheet with riveting at corners. Introduction, Classification of machine tools and cutting tolls, Basic operations on lathe, Drilling, Shaper, Milling, Cutting tool material, Work-holding devices, To make a job using step turning and grooving, To make a job using knurling and threading, To make a multi operation job on a Lathe machine, To make V – slot by using shaper machine	CO3
Unit 4	***Smithy Shop and Electrical Shop***	12hr
	Introduction, Types of forging, Equipment used in the smithy shop, Smithy tools, Black smith's hearth, Hand forging operations. To Forge the L – Hook, To Forge a Chisel, To Forge a Cube from a M.S Round, To forge a screw driver. Layout of electrical tube light wiring, Layout of stair case wiring using two-way switch, Testing and rectification of simulated faults in electrical appliances such as 'Electric Iron' Ceiling Fan. Electric kettle, To fabricate a circuit for the electrical wiring of Fan with regulator and Bulb through a main switch and its testing using a series lamp	CO4
Text Books	1. Johl, K. C. Mechanical Workshop Practice. Prentice Hall India, 1st Edition, 2010. Print. 2. Bawa, H.S. Workshop Technology. New Delhi: Tata McGraw Hill, 7th Edition, 2004. Print. 3 Amrinder Singh, Manufacturing Practice. Mahalakshmi Publication, New Delhi.	
Reference Books	1. Kalpakjian S. And Steven S. Schmid, "Manufacturing Engineering and Technology", 4th edition, Pearson Education India Edition, 2002. 2. Gowri P. Hariharan and A. Suresh Babu," Manufacturing Technology – I" Pearson Education, 2008. 3. Roy A. Lindberg, "Processes and Materials of Manufacture", 4th edition, Prentice Hall India, 1998.	

In hours			
L	T	P	Credit
2	0	2	3

Course Code	CST110					
Course Title	**Integrated Business Processes in Cloud ERP II**					
Course Outcomes						
Examination Mode	Theory + Practical					
Assessment Tools	Quiz	Assignment	Attendance	MSE	ESE	Total
Weightage	10	10	5	25	50	100
Syllabus						**CO Mapping**

In hours			
L	**T**	**P**	**Credit**
1	0	2	2

Course Code	**EVS104**						
Course Title	**Environment Studies**						
Course Outcomes	On the completion of the course, the student will gain the following knowledge and skills: **CO1**: **To Understand the interconnected and interdisciplinary nature of environmental studies and develops critical thinking skills in relation to environmental affairs. Acquire knowledge about the depletion of the root cause of natural resources and their effective management.** **CO2**: **To aware about the ecosystems, biodiversity and its importance to mankind. Interpret and propose solutions to various environmental pollution, solid waste and disaster management.** **CO3**: **Expand awareness of self in a global society and effectively engage diverse perspectives, values, and cultures, ranging from local to global in dealing with environmental and social issues. Awareness about effect of population increase on humans itself. Causes of spread of different diseases in society. How Indian government is supporting women and children that considered weakest section of society.** **CO4**: **Field visits and practical applications will help the students to enhance their skills for the betterment of environment.**						
Examination Type	Theory + Practical						
Assessment Tools	Written Quiz	Assignment/Project Work	MSE	MSP	ESE	ESP	Attendance
Weightage	**10**	**0**	**25**	**0**	**35**	**25**	**5**
Examination Mode	Theory + Practical						
Syllabus	**Unit 1: (8 hours)** **Introduction to Environmental Studies, Natural Resources and Ecosystem** • The multidisciplinary nature of environmental studies • Natural Resources: Renewable and non-renewable resources. • Forest resources: Use and over-exploitation • Water resources: Over-utilization of surface and ground water • Mineral resources: Use and exploitation, environmental effects of mining • Food resources: Effects of modern agriculture on environment • Energy resources: renewable and non-renewable energy sources. • Land resources: Uses and land degradation, soil erosion • Ecosystem: Structure and function of an ecosystem. Producers, consumers and decomposers						CO1

	• Energy flow in the ecosystem, Ecological succession • Food chains, food webs, ecological pyramids	
	Unit 2: (8 hours) **Biodiversity and Environmental Pollution** • Biodiversity definition. Genetic, species and ecosystem diversity. Bio-geographical classification of India. • Value of biodiversity. India as mega-diversity nation. Hot-spots of biodiversity. • Threats to biodiversity. Man wildlife conflicts. In-situ and Ex-situ conservation of biodiversity. • Environmental Pollution: Definition, causes, effects and control measures of: Air pollution, water pollution, soil pollution, marine pollution, noise pollution, thermal pollution, nuclear pollution • Solid waste management and techniques. • Disaster management: floods, earthquake, cyclone and landslides.	CO2
	Unit 3: (7hours) **Social Issues, Human Population and Environment** • Sustainable Development: From unsustainable to sustainable development. Urban problems related to energy. • Water conservation: Rain water harvesting and watershed management. Resettlement and rehabilitation of people • Environmental Issues: Climate change, global warming, acid rain, ozone depletion, nuclear accidents and holocaust. • Wasteland reclamation. Consumerism and waste products. • Environmental Laws: The Environment Protection Act, 1986; The Air Act, 1981; The Water Act, 1974; The Wildlife Protection Act, 1972; Forest Conservation Act, 1980. • Human Population and Environment: Population growth and population explosion, causes and effects • HIV/ AIDS • Women and child welfare programmes in India • Role of IT in environment and human health.	CO3
	Unit 4: (12 hours) **Practical's and field study** • Visit to sewage treatment plant and rain water harvesting system • Solid waste management by vermi-composting and biogas plant • Visit to incineration plant of your area. • A visit to pond, river and lake ecosystem	CO4

	• Visit to different industries with respect to pollution • Testing of water parameters: Hardness, pH, Conductivity, Total dissolved solids, Total suspended solids, BOD and DO • Study of plants in their natural habitat	
Reference Books:	1. Garg, S. K. Sewage Disposal and Air Pollution Engineering. Khanna Publishers, Delhi, 2003. 2. Botkin, D.B. and Kodler, E.A. Environmental Studies: The Earth as a living planet. New York: John Wiley and Sons Inc., 2000. 3. Odum, E.P. Basic Ecology. Japan: Halt Saundurs, 1983. 4. Oliver, S. O. and Daniel, D. C. Natural Resource Conservation: Management for a Sustainable future. Prentice Hall International, New Jersey, 1990. 5. Rai, G. D. Non-Conventional Energy Sources, Khanna Publishers, Delhi, 1993. 6. Sharma, P. D. Ecology and Environment. Meerut Rastogi Publications, 2004. 7. Singh, J.S., Singh, S.P. and Gupta, S. R. Ecology, Environment and Resource Conservation. New Delhi: Anamaya Publishers, 2006. 8. Smith, R.L.Ecology and Field Biology, Harper Collins, New York, 1996. 9. Alloway, B. J. and Ayres, D.C. Chemical Principles of Environmental Pollution. Blackie Academic and Professional, London, 1997. 10. Chapman, J. L. and Reiss, M. J. Ecology: Principles and Applications. Cambridge University Press, UK, 1998. 11. De, A.K. Environmental Chemistry. New Delhi: Wiley Eastern Ltd., 1990. 12. Muller-Dombols, D. and Ellenberg, H. Aims and Methods of Vegetation Ecology, Wiley, New York, 1974. 13. Singh, J. S. Restoration of Degraded Land: Concepts and Strategies. Rastogi Publications, Meerut, 1993. **14.** Wright, R. T. and Nebel, B. J. Environmental Science, 8th Ed. Prentice Hall India Ltd., 2004.	

In hours			
L	**T**	**P**	**Credit**
1	0	2	2

Course Code	**ENH112**						
Course Title	**Cambridge English II**						
Course Outcomes	On the completion of the course the student will be able to **CO1: Proficiently handle diverse communication situations, including listening to complaints, news stories, and podcasts; discussing careers and experiences; expressing emotions and cultural expectations; and writing critical online reviews.** **CO2: Consolidate advanced grammar and vocabulary knowledge for accurate and appropriate language usage.** **CO3: Utilize comprehensive audio and video resources to develop effective language comprehension and production.** **CO4: Effective Communication in Diverse Contexts: Demonstrate fluency, coherence, and confidence in expressing complex ideas, drawing conclusions, discussing hypothetical situations, and describing qualities for success.**						
Examination Mode	Theory + Practical						
	Written Quiz	Assignment/Project Work	MSE	MSP	ESE	ESP	Attendance **5**
Weightage	**10**			**20**	**35**	**30**	

Syllabus		CO Mapping
Unit 1	**Unit 1: (10 hours)** **Listening: Advanced Listening I** Listening for descriptions of people; listening for opinions; listening to people making, accepting, and declining requests; listening to messages and a podcast. **Speaking – Advanced Speaking I** Describing personalities; expressing likes and dislikes; agreeing and disagreeing; complaining; talking about possible careers; deciding between two jobs, Making direct and indirect requests; accepting and declining requests, Narrating a story **Writing / Reading – Advanced Reading/ Writing I** Writing a description of a good friend, Reading about unusual social networking sites, Writing about two career choices, Reading about different types of workplaces, Writing a message with requests, Writing a personal account, Reading about the reliability of online content topics **Grammar – Advanced English Grammar I** Relative pronouns as subjects and objects; it clauses + adverbial clauses with when; Gerund phrases as subjects and objects; comparisons with adjectives, nouns, verbs, and past participles, Requests with modals, if clauses, and gerunds; indirect requests, Past continuous vs. simple past; past perfect;	CO1 CO1 CO1 CO2
Unit 2	**Unit 2: (10 hours)** **Advanced Communication II** **Listening – ADVANCED LISTENING II** Listening for information about living abroad; listening to opinions about customs, Listening to complaints; listening to people exchange things in a	CO1

	store; listening to a conversation about a "throwaway culture," Listening to environmental problems; listening for solutions, Listening to a conversation with a guidance counselor; listening for additional information **Speaking – ADVANCED SPEAKING II** Talking about moving abroad; expressing emotions; describing cultural expectations; giving advice; describing problems; making complaints; explaining something that needs to be done; identifying and describing problems; coming up with solutions; asking about preferences; discussing different skills to be learned **Writing/ Reading – ADVANCED READING/ WRITING II** Writing a pamphlet for tourists, Reading about moving to another country, Writing a critical online review, Reading about a problem with a ride-sharing service, Writing a post on a community website, Reading about a creative solution to lionfish on St. Lucia, Writing about a skill, Reading about different studying styles **Grammar - ADVANCED GRAMMAR II** Noun phrases containing relative clauses; expectations: *the custom to*, (*not*) *supposed to*, *expected to*, (*not*) *acceptable to; d*escribing problems with past participles as adjectives and with nouns; describing problems with *need* + gerund, *need* + passive infinitive, and *keep* + gerund, Passive in the present continuous and present perfect; prepositions of cause; infinitive clauses and phrases, *Would rather* and *would prefer*; *by* + gerund to describe how to do things	CO1 CO4 CO2
Unit 3	**Unit 3: (10 hours)** **Listening – ADVANCED LISTENING III** Listening to New Year's resolutions, Listening for dates and time periods; listening to predictions, Listening to descriptions of important events; listening to regrets and explanations, Listening for features and slogans **Speaking – ADVANCED SPEAKING II** Talking about moving abroad; expressing emotions; describing cultural expectations; giving advice; describing problems; making complaints; explaining something that needs to be done; identifying and describing problems; coming up with solutions; asking about preferences; discussing different skills to be learned. **Writing / Reading – ADVANCED READING/ WRITING III** Writing a message of advice, Reading about young scientist Jack Andraka, Writing a biography, Reading about futurists and their predictions for the year 2050, Writing a message of apology, Reading about a conflict with a friend and advice on how to fix it, Writing a TV or web commercial, Reading about what makes some advertisements memorable, **Grammar – ADVANCED GRAMMAR III** Get or have something done; making suggestions with modals + verbs, gerunds, negative questions, and infinitives; referring to time in the past with adverbs and prepositions: *during*, *in*, *ago*, *from…to*, *for*, *since*; predicting the future with *will*, future continuous, and future perfect, Time clauses: *before*, *after*, *once*, *the moment*, *as soon as*, *until*, *by the time*; expressing regret with *should* (*not*) *have* + past participle; describing hypothetical situations with *if* clauses + past perfect and *would*/*could have* + past participle	CO1 CO2 CO3 CO2

Unit 4	**Unit 4: (10 hours)** **Listening – ADVANCED LISTENING IV** Listening to explanations; listening for the best solution, Listening for parts of a movie, Listening for solutions to everyday annoyances; listening to issues and Opinions, Listening to past obstacles and how they were overcome, listening for people's goals for the future **Speaking – ADVANCED SPEAKING IV** Drawing conclusions, offering explanations; describing hypothetical events; giving advice for complicated situations, Describing how something is done or made; describing careers in film, TV, publishing, gaming, and music, Giving opinions for and against controversial topics; offering a different opinion; agreeing and disagreeing, Giving opinions about inspirational sayings; talking about the past and the future. **Writing/ Reading – ADVANCED READING/ WRITING II** Writing a pamphlet for tourists, Reading about moving to another country, Writing a critical online review, Reading about a problem with a ride-sharing service, Writing a post on a community website, Reading about a creative solution to Lion fish on St. Lucia, Writing about a skill, Reading about different studying styles **Grammar - ADVANCED GRAMMAR IV** Past modals for degrees of certainty: *must (not) have*, *may (not) have*, *might (not) have*, *could (not) have*; past modals for judgments and suggestions: *should (not) have*, *could (not) have*, *would (not) have,* The passive to describe process with *is*/*are* + past participle and modal + *be* + past participle; defining and non-defining relative clauses, Giving recommendations and opinions with passive modals: *should be*, *ought to be*, *must be*, *has to be*, *has got to be*; tag questions for opinions, Accomplishments with the simple past and present perfect; goals with the future perfect and *would like to have* + past participle	CO3 CO4 CO3 CO2
Text Books	***Interchange Level 3 - 5th edition*** published by Cambridge University Press	

In hours			
L	**T**	**P**	**Credit**
1	0	2	2

Course Code	**CST213**						
Course Title	**Basic ABAP Programming**						
Course Outcomes							
Examination Type	Theory + Practical						
Assessment Tools	Written Quiz	Assignment/Project Work	MSE	MSP	ESE	ESP	Attendance
Weightage	**10**		**25**		**35**	**25**	**5**
Examination Mode	Theory + Practical						

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

Course Code	**CST215**						
Course Title	**Intermediate ABAP Programming**						
Course Outcomes							
Examination Type	Theory						
Assessment Tools	Written Quiz	Assignment/Project Work	MSE	MSP	ESE	ESP	Attendance
Weightage	**10**	**10**	**25**	**-**	**50**	**-**	**5**
Examination Mode	Theory						
Syllabus							
Reference Books:							

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

Course Code	**CST205**						
Course Title	**Data structures**						
Course Outcomes	On the completion of the course, the student will gain the following knowledge and skills: Theory: CO1: Understand the concept of data structure, memory management, data types, Algorithms, Big O notation. CO2: Understand basic data structures such as arrays, linked lists, stacks and queues. CO3: Operations performed on linear and nonlinear data structures. CO4: Solve problem involving graphs, trees and heaps CO5: Apply Algorithm for solving problems like sorting, searching, insertion and deletion of data. Practical: CO1: Be able to design and analyse the time and space efficiency of the data structure CO2: Be capable to identity the appropriate data structure for given problem CO3: Have practical knowledge on the applications of data structure						
Examination Type	Theory + Practical						
Assessment Tools	Written Quiz	Assignment/Project Work	MSE	MSP	ESE	ESP	Attendance
Weightage	**10**		**25**		**35**	**25**	**5**
Examination Mode	Theory + Practical						
Syllabus	**Unit 1: (15 hours)** ● **Introduction** Basic terminology: Elementary Data Organizations, Data Structure Operations: insertion, deletion, traversal etc.; Analysis of an Algorithm, Asymptotic Notations, Time-Space trade off Algorithms, Control Structure and Complexity of Algorithms. ● **Array** Representation of Linear array in memory, Traversing linear Array, Searching Techniques: Linear search, Binary Search, Complexity of linear search and binary search and their analysis and 2D-Array, Representation of 2D-Array in memory. Records, Record Structures. **Practical:** ● W.A.P and algorithm to check whether the number is greater or not. ● W.A.P and algorithm to print whether the given number is even or odd. ● W.A.P and algorithm to check whether the entered number is prime or not. ● W.A.P to perform various types of Arithmetic operations. ● W.A.P to store the marks of a student in array and then print the result.						**CO1**

	• W.A.P to traversing of linear array. • W.A.P to implement Linear Search. • W.A.P to implement Binary Search. • W.A.P to generate the Fibonacci series using Array. • W.A.P to find the transpose of matrix. • W.A.P to addition, subtraction and multiplications of two matrix.	
	Unit 2: (15 hours) • **Linked List** Representation of Linear Linked List, Traversing a linked list, Operations on linked list, Memory Allocation, Garbage collection, Overflow and Underflow. Doubly linked list, Operations on 2-way linked list, Advantages and disadvantages of 2-way linked list, Circular Linked List, Header Linked Lists, types of header linked list and Application of linked list. **Practical:** • W.A. P to implement one-way linked list. • W.A.P to implement various operations performed on one-way linked list. • W.A. P to implement two- way linked list. • W.A.P to implement various operations performed on two-way linked list.	**CO2**
	Unit 3: (17 hours) • **Stacks and Queues** Array representation of stacks/Operation on Stack: Push and pop, Arithmetic Expressions; Polish Notation, Evaluation of a postfix expression, Transforming infix expression into postfix expressions. Quick Sort: An Application of Stack, Complexity of Quick Sort, Recursion: Factorial function, Fibonacci sequence and Towers of HANOI. Representation of Queue, Operations performed on Queues, Deques and Priority Queues. • **Trees** Basic terminology, Binary Trees, Complete Binary Trees, Extended Binary Trees: 2-Trees, Representation of binary trees in memory. Traversing Binary Trees: Pre order, In order and Post order. Binary Search Trees, Searching& Inserting in Binary Search Tree, Deleting in a binary search tree. Heap, Heapsort,deleting the root of a Heap, General trees and Computer representation of General trees.AVL Tree; Applications of Binary Trees. B Tree, B+ Tree. **Practical:** W.A.P to demonstrate the operation performed on stack. W.A.P to implement TOWER of HANOI. W.A.P to implement PUSH and POP operations of stack. W.A.P to evaluation of a Postfix Expression.	**CO3**
	Unit 4: (13 hours) • **Graph**	**CO4**

	Basic Terminology, Representation of Graph, Traversing of Graph: Breadth-First Search and Depth-First Search and Applications of Graphs etc. ● **Sorting and Hashing** Bubble Sort, Insertion Sort, Selection Sort, Merge Sort, Bucket Sort, Radix Sort, Hashing and Hash Function sets. **Practical:** ● W.A.P to implement Bubble Sort. ● W.A.P to implement Selection sort. ● W.A.P to insert and delete node from graph. ● W.A.P to implement Breadth First Search. ● W.A.P to implement Depth First Search.	
References Books:	1. LipschutzSchaumseries: TataMcGrawHill. 2. Y.Langsam, M.J.Augenstein, A.M.Tanenbaum,Data Structures using C and C++,2nd Edition, Pearson Education 3. R.Kruse, C.L.Tondo,B.Leung,S.Mogalla,Data Structures & Program Design in C.2nd Edition, Pearson Education 4. Fundamentals of Data Structures", Illustrated Edition by Ellis Horowitz, SartajSahni, Computer Science Press. 5. Algorithms, Data Structures, and Problem Solving with C++", Illustrated Edition by Mark Allen Weiss, Addison-Wesley Publishing Company 6. Data Structures, RS Salaria, Khanna Publishing House	

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

Course Code	**CST207**						
Course Title	**Digital Electronics**						
Course Outcomes	On the completion of the course, the student will gain the following knowledge and skills: CO1:-Students will be able to represent numerical values in various number systems and perform number conversions between different number systems, various codes and operation of logic gates (AND, OR, NOT, NAND, NOR, XOR, XNOR) CO2:-Students will demonstrate the knowledge of: Boolean algebra including algebraic manipulation/simplification, and application of DeMorgan's theorems. Karnaugh map and Q-M reduction method. Able to analyse and design digital combinational circuits including arithmetic circuits (half adder, full adder), decoders, encoders, multiplexers, and de-multiplexers, code converters. CO3:- Students will Analyse the synchronous and asynchronous logic circuits such as flip flops, registers, and counters and able to understand/D and D/A converters. CO4:- Students will be able to understand various types of memories and logic families. CO5: To exihibit project planning Practical: CO1: Learn the basics of gates. CO2: Construct basic combinational circuits and verify their functionalities CO3: Apply the design procedures to design basic sequential circuits CO4: Learn about counters CO5: Learn about Shift registers CO6: To understand the basic digital circuits and to verify their operation							
Examination Type	Theory + Practical						
Assessment Tools	Written Quiz	Assignment/Project Work	MSE	MSP	ESE	ESP	Attendance
Weightage	**10**		**25**		**35**	**25**	**5**
Examination Mode	Theory + Practical						
Syllabus	**Unit 1: (13 hours)** Number System and Binary Code: Introduction, Binary, Octal, Hexadecimal Number system:-Conversions, Addition, Subtractions, Multiplication, Division, Weighted and Non-weighted codes, Signed - unsigned numbers, Binary Subtractions using 1's and 2's compliment, ASCII code, Excess 3 code, Grey code, BCD code and BCD additions & BCD						**CO1**

	Subtractions. Review of gates: - OR, AND, NOT, NOR, NAND, EXOR, EX-NOR, Universal gates. Minimization of logic function: Basic theorem of Boolean algebra, Sum of Products and Product of Sums, canonical form, Minimization using: - Boolean algebra and K-map.	
	Unit 2: (14 hours) Combinational Circuits: Introduction, Combinational circuit design, Encoders, decoders, Adders, Sub tractors and Code converters, Parity checker, seven segment display, Magnitude Comparators. Multiplexers, De-multiplexer, Implementation of Combinational circuit using Multiplexers and De-multiplexer.	**CO2**
	Unit 3: (15 hours) Sequential Circuits: Introduction, flip flops, Clocked flip flops, SR, JK, D, T and edge triggered Flip-flops, Conversions of Flip flops, Shift Registers, Type of Shift Registers, Serial to parallel converter, parallel to serial converter Ring Counter, Twisted Ring Counter, ripple (Asynchronous) counters, synchronous counters, counters design using flip flops D/A and A/D Converters: Introduction, Weighted register D/A converter, binary ladder D/A Converter, A/D converter:- Parallel Comparator, Counter type, Continuous, Successive approximation, Single and dual slope A/D converter, A/D accuracy and resolution. Logic Families: RTL, DCTL, DTL, TTL, ECL, CMOS and its various types, Comparison of logic families.	**CO3**
	Unit 4: (18 hours) ● Verification of the truth tables of TTL gates, e.g., 7400, 7402, 7404, 7408, 7432, 7486. ● Verify the NAND and NOR gates as universal logic gates. ● Verification of the truth table of the Multiplexer 74150. ● Verification of the truth table of the De-Multiplexer 74154. ● Design and verification of the truth tables of Half and Full adder circuits. ● Design and verification of the truth tables of Half and Full subtractor circuits.	**CO4**

	● Design and test of an S-R flip-flop using NOR/NAND gates. a) Verify the truth table of a J-K flip-flop (7476) b) Verify the truth table of a D flip-flop (7474) ● Operate the counters 7490, 7493 and 74194. Verify the frequency division at each stage and with a low frequency clock (say 1 Hz) display the count on LEDs.	
References Books:	1. Morris Mano, Digital Design, Prentice Hall of India Pvt. Ltd 2. Donald P.Leach and Albert Paul Malvino, Digital Principles and Applications, 5 ed., Tata McGraw Hill Publishing Company Limited, New Delhi, 2003. 3. R.P.Jain, Modern Digital Electronics, 3 ed., Tata McGraw–Hill publishing Company limited, New Delhi, 2003. 4. Thomas L. Floyd, Digital Fundamentals, Pearson Education, Inc, New Delhi, 2003 5. Ronald J. Tocci, Neal S. Widmer, Gregory L. Moss, Digital System -Principles and Applications, Pearson Education. 6. Roth, Fundamentals of Logic Design, Cengage Learning	

In hours			
L	T	P	Credit
3	0	0	3

Course Code	**CST209**						
Course Title	**Discrete Mathematics**						
Course Outcomes	On the completion of the course, the student will gain the following knowledge and skills: **CO1: Analyse logical propositions via truth tables.** **CO2: Determine properties of relations, identify equivalence and partial order relations, sketch relations.** **CO3: Understand sets and perform operations and algebra on sets.** **CO4: Define basic tree data structures and identify algorithmic functions associated with them** **CO5: Define graphs, digraphs, and identify their main properties.** **CO6: Evaluate combinations and permutations on sets**.						
Examination Type	Theory						
Assessment Tools	Written Quiz	Assignment/Project Work	MSE	MSP	ESE	ESP	Attendance
Weightage	**10**	**10**	**25**		**50**		**5**
Examination Mode	Theory						
Syllabus	**Unit 1: (11 hours)** ● **Set Theory and Logic:** Propositional Logic, First Order Logic, Predicate Calculus and Qualifiers; Proof Methods; Sets, Functions, Relations, Cardinality, Induction and Recursion; Modular Arithmetic; Boolean algebra, Infinity and Diagonalisation.						**CO1**
	Unit 2: (12hours) ● **Coding Theory and Counting:** Coding Theory: Error correcting coding, Hamming codes, Hamming bound; Basic Counting- Pigeon hole principle; advanced counting- recurrence relations, generating functions, inclusion –exclusion. ● **Information Theory and Probability**: Basic information theory, entropy, inequality, mutual information, upper and lower bounds; Probability – sample space, conditional probability, variance, Markov, Chebyshev, probabilistic methods.						**CO2**
	Unit 3: (12 hours) ● **Number System and Binary Code:** Introduction, Binary, Octal, Hexadecimal & some nonstandard Number:-Conversions, Addition, Subtractions, Multiplication,						**CO3**

	Division, Weighted- Non weighted codes, Signed - unsigned numbers, Binary Subtractions using 1's and 2's compliment, ASCII code, Excess 3 code, Grey code, BCD code and BCD additions & BCD Subtractions. ● **Minimization of logic function:** Review of gates: - OR, AND, NOT, NOR, NAND, EX-OR, EX-NOR, Universal gates.	
	Unit 4: (11 hours) ● **Graph Theory:** Graphs and digraphs, incidence and adjacency matrices, isomorphism; Connectivity: Cut vertices, cut edges; Paths and Cycles; Traveling Salesman problem, diameter and maximum degree, shortest paths; Eulerian, Hamiltonian & Planar graphs, duality, Euler's formula, Kuratowski's theorem, Edge and vertex coloring; Trees- Binary and Spanning	**CO4**
References Books:	1. Seymour Lipschutz, Set Theory and Related Topics, McGraw Hill Education. 2. V. K. Balakrishnan, Introductory Discrete Mathematics, Dover Publications Inc. 3. Seymour Lipschutz, Essential computer Mathematics, McGraw Hill Education. 4. NarsinghDeo, Graphy Theory with Applications To Engineering And Computer Science, Prentice Hall India Learning Private Limited	

In hours			
L	T	P	Credit
1	0	2	2

Course Code	**CEC101**						
Course Title	**Community Engagement Course**						
Course Outcomes	On the completion of the course, the student will gain the following knowledge and skills: CO1: Gain an understanding of rural life, culture and social realities CO2: Develop a sense of empathy and bonds of mutuality with local community CO3: Appreciate significant contributions of local communities to Indian society and economy CO4: Learn to value the local knowledge and wisdom of the community CO5: Identify opportunities for contributing to community's socio-economic improvements						
Examination Type	Theory + Practical						
Assessment Tools	Written Quiz	Assignment/Project Work	MSE	MSP	ESE	ESP	Attendance
Weightage	**10**	**-**	**-**	**20**	**35**	**30**	**5**
Examination Mode	Theory + Practical						
Syllabus	**Unit 1: (15hours)** ● **Appreciation of Rural Society:** Rural life style, rural society, caste and gender relations, rural values with respect to community, nature and resources, elaboration of "soul of India lies in villages' (Gandhi), rural infrastructure. ● **Teaching Methodology:** Classroom Discussions ● **Assignment:** Prepare a map (physical, visual or digital) of the village you visited and write an essay about inter-family relations in that village. ● **Mode of Assignment Submission:** Written Assignment **Practical:** ● Interaction with SHG women members, and study of their functions and challenges; planning for their skill building and livelihood activities. ● Visit MGNREGS project sites, interact with beneficiaries and interview functionaries at the work site. ● Field visit to Swachh Bharat project sites, conduct analysis and initiate problem solving measures. ● Conduct Mission Antyodaya surveys to support under Gram Panchayat Development Plan (GPDP).						**CO1**
	Unit 2: (15hours) ● **Understanding rural economy & livelihood:** Agriculture, farming, landownership, water management,						**CO2**

	animal husbandry, non-farm livelihoods and artisans, rural entrepreneurs, rural markets ● **Teaching Methodology:** Group Discussions in Class ● **Assignment:** Describe your analysis of rural household economy, its challenges and possible pathways to address them. ● **Mode of Assignment Submission:** Written Assignment **Practical:** ● Interactive community exercise with local leaders, panchayat functionaries, grass-root officials and local institutions regarding village development plan preparation and resource mobilization. ● Visit Rural Schools / mid-day meal centres, study Academic and infrastructural resources and gaps. ● Participate in Gram Sabha meetings, and study community participation. ● Associate with Social audit exercises at the Gram Panchayat level, and interact with programme beneficiaries. ● Attend Parent Teacher Association meetings, and interview school drop outs Fostering Social Responsibility & Community Engagement in Higher Education Institutions in India.	
	Unit 3: (15hours) ● **Rural Institutions:** Traditional rural organisations, Self-help Groups, Panchayati raj institutions (Gram Sabha, Gram Panchayat, Standing Committees), local civil society, local administration. ● **Teaching Methodology:** Classroom Discussions ● **Assignment:** How effectively are Panchayati raj institutions functioning in the village? What would you suggest to improve their effectiveness? Present a case study (written or audio-visual). ● **Mode of Assignment Submission:** Group presentations of Assignment **Practical:** ● Visit local Anganwadi Centre and observe the services being provided ● Visit local NGOs, civil society organisations and interact with their staff and beneficiaries, ● Organize awareness programmes, health camps, Disability camps and cleanliness camps ● Conduct soil health test, drinking water analysis, energy	**CO3**

	use and fuel efficiency surveys ● Raise understanding of people's impacts of climate change, building up community's disaster preparedness	
	Unit 4: (15hours) ● **Rural Developmental Programmes:** History of rural development in India, current national programmes: Sarva Shiksha Abhiyan, Beti Bachao, Beti Padhao, Ayushman Bharat, Swatchh Bharat, PM AwaasYojana, Skill India, Gram panchayat Decentralised Planning, NRLM, MNREGA, etc. ● **Teaching Methodology:** Classroom Discussions **Practical:** ● Organise orientation programmes for farmers regarding organic cultivation, rational use of irrigation and fertilizers and promotion of traditional species of crops and plants. ● Formation of committees for common property resource management, village pond maintenance and fishing.	**CO4**
Reference Books:	1. Singh, Katar, Rural Development: Principles, Policies and Management, Sage Publications, New Delhi, 2015. 2. A Hand book on Village Panchayat Administration, Rajiv Gandhi Chair for Panchayati Raj Studies, 2002. 3. United Nations, Sustainable Development Goals, 2015 un.org/sdgs/ 4. M.P.Boraian, Best Practices in Rural Development, Shanlax Publishers, 2016.	

In hours			
L	**T**	**P**	**Credit**
1	0	2	2

Course Code	**CST214**						
Course Title	**Data modelling in ABAP dictionary and ABAP CDS**						
Course Outcomes							
Examination Type	Theory + Practical						
Assessment Tools	Written Quiz	Assignment/ Project Work	MSE	MSP	ESE	ESP	Attendance
Weightage	**10**	**-**	**25**	**-**	**25**	**35**	**5**
Examination Mode	Theory + Practical						
Syllabus							

Reference Books:		

In hours			
L	**T**	**P**	**Credit**
1	0	2	2

Course Code	**CST216**						
Course Title	**Transactional Apps with ABAP RESTFUL application programming model**						
Course Outcomes							
Examination Type	Theory + Practical						
Assessment Tools	Written Quiz	Assignment/ Project Work	MSE	MSP	ESE	ESP	Attendance
Weightage	**10**	**-**	**25**	**-**	**25**	**35**	**5**
Examination Mode	Theory + Practical						
Syllabus							
Reference Books:							

In hours			
L	**T**	**P**	**Credit**
1	0	2	2

Course Code	**CST218**						
Course Title	**Introduction to application programming in SAP HANA**						
Course Outcomes							
Examination Type	Theory + Practical						
Assessment Tools	Written Quiz	Assignment/ Project Work	MSE	MSP	ESE	ESP	Attendance
Weightage	**10**	**-**	**25**	**-**	**25**	**35**	**5**
Examination Mode	Theory + Practical						
Syllabus							
Reference Books:							

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

Course Code	**CST204**						
Course Title	**Data Communication and Networking**						
Course Outcomes	On the completion of the course, the student will gain the following knowledge and skills: CO1: Understand the basics of data communication, networking, signals and Network Categories CO2: To study about data models and usage of transmission media. CO3: Error correction and detection techniques and analyse the services provided by protocols and features of various protocols in data networks. CO4: To know about various routing algorithms used in network layer. CO5: Recognize and use of various types of protocols used in transport layer and application layer						
Examination Type	Theory + Practical						
Assessment Tools	Written Quiz	Assignment/Project Work	MSE	MSP	ESE	ESP	Attendance
Weightage	**10**		**25**		**35**	**25**	**5**
Examination Mode	Theory + Practical						
Syllabus	**Unit 1: (18 hours)** ● **Introduction** Data Communication: Components, Data Flow; Network Categories: LAN, MAN, WAN (Wireless / Wired); Network Software: Concept of layers, protocols, interfaces and services; Reference ● Model: OSI, TCP/IP and their comparison. ● **Physical Layer** Concept of Analog & Digital Signal; Bit rate, Bit Length; Transmission Impairments: Attenuation, Distortion, Noise; Data rate limits: Nyquist formula, Shannon Formula; Multiplexing: Frequency Division, Time Division, Wavelength Division; Transmission media: Twisted pair, coaxial cable, fiber optics, wireless transmission (radio, microwave, infrared);Circuit Switching & Packet Switching. **Practical:** ● Making Straight, Rollover and Cross-Over cables ● Cable & RJ-45 Jack outlet installation ● Basic LAN Setup and IP Addressing ● Write a program for error detecting cod						**CO1**
	Unit 2: (14 hours) ● **Data Link Layer** Error correction & Detection; Flow & Error Control; Sliding window protocols: Stop & Wait ARQ,						**CO2**

	Go back n ARQ, Selective repeat ARQ; Examples of DLL Protocols-HDLC, PPP; Medium Access Sub layer: Channel Allocation; Random Access: ALOHA, CSMA protocols; Controlled Access: Polling, Reservation, Token Passing. **Practical:** ● Write a program for Hamming Code generation for error detection and correction ● Write a program for congestion control using Leaky bucket algorithm. ● Study of Amplitude Modulation	
	Unit 3: (15 hours) ● **Network Layer:** Routing algorithms- Distance vector, Link State Routing, Hierarchical Routing, Broadcast & Multicast Routing; Congestion Control: Principles of Congestion Control, Congestion Prevention policies, Leaky bucket &Token bucket algorithms**.** **Practical:** ● Study of Frequency Modulation ● Study of ASK Modulation ● Study of FSK Modulation	**CO3**
	Unit 4: (13 hours) ● **Transport Layer:** Addressing, flow control & buffering, multiplexing & de-multiplexing, crash recovery; Example transport protocols: TCP, SCTP and UDP. ● **Application Layer:** Network Security; Domain Name System; Simple Network Management Protocol; Electronic Mail. **Practical:** ● Study of ASK Modulation ● Study of FSK Modulation ● Implementation of STOP and Wait protocol ● Implementation of Sliding Window protocol	**CO4**
Reference Books:	1. Andrew S. Tanenbaum "Computer Networks" Ed Pearson Education 4th Edition, 2003. 2. James F. Kurose and Keith W. Ross "Computer Networking" Pearson Education, 2002. 3. William Stalling, "Data and Computer Communication", Pearson Education, 7th Edition, 2nd 4. Indian Reprint 2004. 5. Miller "Data and Network Communication" Ed Thomson Learning, 2001. 6. Douglas E Comer, "Computer Networks and Internets", Pearson Education 2nd Edition, 5th Indian Reprint 2001	

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

Course Code	**CST206**						
Course Title	**Operating System Concepts**						
Course Outcomes	On the completion of the course, the student will gain the following knowledge and skills: CO1: Understand Functions, Services and structure of Operating Systems. CO2: Understand processes, schedulers and explanation of CPU scheduling. CO3: Understand issues related to Process Synchronization and focus on principles of Deadlock and related problems. CO4: Comprehend the mechanisms used in Memory Management and Virtual Memory. CO5: Understand the concepts of File System, secondary storage management and Disk Scheduling Practical: CO1: Analyse process management and simulate CPU Scheduling Algorithms like FCFS, Round Robin, SJF, and Priority, Deadlock management. CO2: Implement memory management schemes and page replacement schemes. CO3: Implement file allocation methods and disk scheduling algorithms. CO4: Experiment with UNIX commands and shell programming						
Examination Type	Theory + Practical						
Assessment Tools	Written Quiz	Assignment/Project Work	MSE	MSP	ESE	ESP	Attendance
Weightage	**10**		**25**		**35**	**25**	**5**
Examination Mode	Theory + Practical						
Syllabus	**Unit 1: (15 hours)** ● **Introduction:** What is an O.S., O.S. Functions; Different types of O.S.: batch, multi-programmed, time sharing, real-time, distributed, parallel; General structure of operating system, O/S services, system calls. ● **Process Management:** Introduction to processes - Concept of processes, process scheduling, Process control block, operations on processes; Inter process communication, Critical sections, Semaphores, Message passing; CPU scheduling- scheduling criteria, preemptive & non-preemptive scheduling, Scheduling algorithms (FCFS, SJF, RR and priority). Multiprocessor scheduling: Real Time scheduling: RM and EDF. **Practical:** ● Simulation of the CPU scheduling algorithms a) Round Robin b)SJF c)FCFS d)Priority ● Simulation of MUTEX and SEMAPHORES. ● Simulation of Bankers Deadlock Avoidance and Prevention algorith						**CO1**

	Unit 2: (15 hours) ● **Inter-process Communication:** Critical Section, Race Conditions, Mutual Exclusion, Hardware Solution, Strict Alternation, Peterson's Solution, The Producer-Consumer Problem, Semaphores, Event Counters, Monitors, Message Passing, Classical IPC Problems: Reader's & Writer Problem, Dinning Philosopher Problem etc. ● **Memory Management:** Background, logical vs. physical address space, swapping; contiguous memory allocation, internal & external fragmentation, memory-compaction, paging, segmentation, Virtual Memory, demand paging, page replacement, page replacement algorithms (FIFO, Optimal, LRU); Thrashing. **Practical:** ● Simulation of Page Replacement Algorithms a)FIFO b)LRU c)LFU ● Simulation of paging techniques of memory management.	**CO2**
	Unit 3: (15 hours) ● **File Systems:** Files - file concept, file structure, file types, access methods, File attributes, file operations; directory structure, allocation methods (contiguous, linked, indexed), free-space management (bit vector, linked list, grouping), Protection mechanisms. ● **Secondary Storage:** Disk Structure, Disk Scheduling (FCFS, SSTF, SCAN, C-SCAN, and LOOK). **Practical:** ● Simulation of file allocation Strategies a)Sequential b)Indexed c)Linked ● Simulation of file organization techniques Single Level Directory; Two Level ; Hierarchical ; DAG	**CO3**
	Unit 4: (15 hours) ● **Deadlocks:** Introduction to deadlocks, Conditions for deadlock, Resource allocation graphs, Deadlock Detection and Recovery, Deadlock Avoidance, Deadlock Prevention. ● **Case Studies:** Brief introduction of MS-DOS, Windows (9x, XP, 2000), UNIX and LINUX **Practical:** ● To automate the allocation of IP addresses i.e. to set and configure the DHCP server and DHCP client. ● Basic Introduction to Linux Operating System and Shell scripting.	**CO4**
References Books:	**1.** Silberchatz/Galvin/Gagne, "Operating System Concepts", John Wiley 6th Edition2001 **2.** Peterson and Silberschatz, "Operating System Concepts", Addison-Wesley 4th Edition 1994. **3.** Milenkoviac, "Operating Systems Concepts and Design", Tata McGraw-Hill 1992. **4.** Charles Crowley, "Operating Systems a Design Oriented Approach", Tata McGraw-Hill 1996.	

	5. Andrews S. Tanenbaum, "Modern Operating Systems", Pearson Education, 2nd edition 2001. **6.** W Richard Stevens, "Linux Network Programming" PHI, Ist Edition 2003	

In hours			
L	T	P	Credit
3	0	2	4

Course Code	**CST208**						
Course Title	**Database Management System**						
Course Outcomes	On the completion of the course, the student will gain the following knowledge and skills: CO1: Model Entity-Relationship diagrams for enterprise level databases CO2: Formulate Queries using SQL and Relational Formal Query Languages CO3: Apply different normal forms to design the Database CO4: Summarize concurrency control protocols and recovery algorithms Practical: CO1. Understand practical knowledge on designing and creating relational database systems using SQL. CO2. Formulate queries using SQL DML/DDL commands. CO3. Formulate queries using different Logical and SQL operators. CO4. Understand the various queries execution such as Aggregating, character, number functions, and group functions, constraints, set operations joins, views and data type conversion. CO5. Understand the concept of Sub queries, Nested Queries and saving of data using Rollback, Commit.						
Examination Type	Theory + Practical						
Assessment Tools	Written Quiz	Assignment/Project Work	MSE	MSP	ESE	ESP	Attendance
Weightage	**10**		**25**		**35**	**25**	**5**
Examination Mode	Theory + Practical						
Syllabus	**Unit 1: (16 hours)** ● **Introduction to Database Systems:** Introduction to Database Systems: Introduction and applications of DBMS, Purpose of database, Data Independence, Database System architecture- levels, Mappings, Database users and DBA, File Systems Versus a DBMS, Advantages of a DBMS, DBMS Layers, Data independence. ● **Relational query languages:** Relational algebra, Tuple and domain relational calculus. **Practical:** ● Introduction to SQL and its Data Types. ● Write the queries for Data Definition and Data Manipulation language. ● Write SQL queries using Logical operators (=, <,>, etc.). ● Write SQL queries using SQL operators (Between, AND, IN (List), Like, ISNULL and also with negating expressions).						**CO1**
	Unit 2: (14 hours) **Data Models:** Data Models Relational Model, Network Model, Hierarchical Model, ER Model: Entities, Attributes and Entity Sets, Relationships and Relationship Sets, Constraints, Weak						**CO2**

	Entities, Comparison of Models, Database Design with the ER Model, Keys. **Practical:** ● Write SQL query using character, number and group functions. ● Write SQL queries for Relational Algebra (UNION, INTERSECT, and MINUS, etc.). ● Write SQL queries for extracting data from more than one table (Equi-Join, Non-Equi- Join , Outer Join)	
	Unit 3: (16 hours) **Database Design:** ● Normalization and Normal Forms, Various dependencies in database (i.e. Functional dependencies, Multi-valued Dependency, Join Dependency, etc.) First, Second and Third Normal Forms, BCNF, Fourth and Fifth Normal Forms, Armstrong's axioms, Dependency preservation, Lossless design. ● **Transaction Management:** ACID Properties, Serializibility, Two-phase Commit Protocol, Concurrency Control, Lock Management, Lost Update Problem, Inconsistent Read Problem , Read-Write Locks, Deadlocks Handling, 2PL protocol and Introduction to Database Recovery and its techniques. **Practical:** ● Write SQL queries for sub queries, nested queries(using ANY, ALL, IN, EXISTS, NOTEXISTS, UNION, INTERSET) ● Concepts for ROLL BACK, COMMIT & CHECK POINTS. ● Creation, altering and dropping of tables and inserting rows into a table (use constraints while creating tables) examples using SELECT command.	**CO3**
	Unit 4: (14 hours) **Database Protection:** Database Threats, Access Control Mechanisms, Grant and Revoke, Firewalls, Encryption and and Digital Signatures, Authentication, Authorization and access control, DAC, MAC and RBAC models, Intrusion detection, SQL injection. **Practical:** ● Queries (along with sub Queries) Constraints. Example: - Select the roll number and name of the student who secured fourth rank in the class. ● Queries using Aggregate functions (COUNT, SUM, AVG, MAX and MIN), GROUP BY, HAVING clauses. ● Queries using Conversion functions (to_char, to_number and to_date), string functions (Concatenation, lpad, rpad, ltrim, rtrim, lower, upper, initcap, length, and substr), date functions (Sysdate, next_day, add_months, last_day, months_between, least, greatest, trunc, round, to_char, to_date) ● Create Views, Cursors, And Triggers and Stored Procedures in PL/SQL.	**CO4**

References Books:	1. Date C J, “An Introduction To Database System”, Addision Wesley, Eighth Edition 2. Korth, Silbertz, Sudarshan, “Database Concepts”, McGraw Hill 3. Elmasri, Navathe, “Fundamentals Of Database Systems”, Addision Wesley, Fifth Edition 4. Bipin C. Desai, “An introduction to Database Systems”, Galgotia Publication 5. Rob and Coronel, “Database Systems 5th Edition”,Cengage Learning, New Delhi	

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

Course Code	**CST301**						
Course Title	**Cryptography and Network Security**						
Course Outcomes	On the completion of the course, the student will gain the following knowledge and skills CO1: Identify the security issues in the network and resolve it. CO2: Analyse the vulnerabilities in any computing system and hence be able to design a security solution. CO3: Evaluate security mechanisms using rigorous approaches by key ciphers and Hash functions. CO4: Demonstrate various network security applications, IPSec, Firewall, IDS, Web Security, Email Security and Malicious software etc.,						
Examination Type	Theory + Practical						
Assessment Tools	Written Quiz	Assignment/Project Work	MSE	MSP	ESE	ESP	Attendance
Weightage	**10**		**25**		**35**	**25**	**5**
Examination Mode	Theory + Practical						
Syllabus	**Unit 1: (**15Hours**)** • Overview of computer networks • Seven-layer architecture, TCP/IP suite of protocols. • Introduction to information Security, Types of information security controls, need of Information Security, Allocation of information security responsibilities • Security mechanisms, Identification of Security threats and their effects on security, Technologies and Security policies, real time Communication security • An introduction to LAN/WAN Security and internet Security, Security Management for the World Wide Web and Internet firewalls and how to get past the firewall, Steganography, Layers and Cryptography. **Practical:** • Implementation of symmetric techniques (Ceaser cipher, mono alphabetic, polyalphabetic, hill- Cipher, vigenere cipher) • Implementation of transposition techniques (Rail-fence, transposition of columns)						**CO1**
	Unit 2: (15 Hours**)** • Overview of Authentication schemes • Password and address based Authentication, Cryptographic Authentication protocols, Trusted Intermediaries and session key establishment						**CO2**

	• Authentication of people: Passwords, Online and offline password guessing, eavesdropping, password and careless users, authentication tokens and biometrics. **Practical:** • Implantation of Block Cipher techniques (Play fair cipher, Data Encryption Standard) • Implementation of algorithm used for Random Number Generation (Blum blum shub) • Implementation of algorithm used for calculating GCD (Euclidean algorithm).	
	Unit 3: (13 Hours**)** • Security handshake pitfalls • Mutual authentication, Integrity for data, Mediated Authentication, Strong password protocols: EKE, SRP, SPEKE and PDM • Public key infrastructure (PKI): Terminology, PKI trust models, Revocation and Authorization futures. • IPsec: Overview of IPsec, IP and IPv6, AH and ESP, IKE, SSL/TLS. **Practical:** • Implementation of algorithm used for calculating multiplicative inverse (Extended-Euclidean) • Implementation of algorithm used for testing for Primarily (Chinese Remainder Theorem) • Implementation of RSA Algorithm.	**CO3**
	Unit 4: (17 hours) • Overview of IT Security, Hacking, Hackers and Types of Hackers, Attacks, Denial of Service Attacks(DoS), types of DOS attacks, Viruses and their characteristics, impact they can have on operations and business, Detection and Prevention Mechanisms, types of virus, The self-Hack Audit, VPN. • Intrusion: Intruders, Audit records, Intrusion detection, distributed intrusion detection, honeypots • Electronic Mail Security: PEM, Structure of PEM Message and S/MIME, PGP etc. **Practical:** • Elliptic Curve Cryptography. • Hash Algorithms: MD5 Message Digest Algorithm, Authentication Protocols. • System Security: Firewalls: Firewall Design Principles	**CO4**
References Books:	1. Date C J, "An Introduction To Database System", Addision Wesley, Eighth Edition 2. Korth, Silbertz, Sudarshan, "Database Concepts", McGraw Hill 3. Elmasri, Navathe, "Fundamentals Of Database Systems", Addision Wesley, Fifth Edition 4. Bipin C. Desai, "An introduction to Database Systems", Galgotia Publication 5. Rob and Coronel, "Database Systems 5th Edition",Cengage Learning, New Delhi	

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

Course Code	**CST303**						
Course Title	**Data Mining & Warehousing**						
Course Outcomes	On the completion of the course, the student will gain the following knowledge and skills CO1: Identify the scope and necessity of Data Mining & Warehousing for the society CO 2: Describe the designing of Data Warehousing so that it can be able to solve the root problems. CO3: To understand various tools of Data Mining and their techniques to solve the real time problems. . CO4: To develop ability to design various algorithms based on data mining tools. CO5: To develop further interest in research and design of new Data Mining techniques. Practical: CO1: The data mining process and important issues around data cleaning, pre-processing and integration. CO2: The principle algorithms and techniques used in data mining, such as clustering, association mining, classification and prediction. **Students are required to perform practical in Oracle/MS SQL Server and STATISTICA Data Miner						
Examination Type	Theory + Practical						
Assessment Tools	Written Quiz	Assignment/Project Work	MSE	MSP	ESE	ESP	Attendance
Weightage	**10**		**25**		**35**	**25**	**5**
Examination Mode	Theory + Practical						
Syllabus	**Unit 1: (15 hours)** • **Introduction:** Data Mining Concepts, Input, Instances, Attributes and Output, Knowledge Representation & Review of Graph Theory, Lattices, Probability & Statistics • **Machine learning concepts and approaches:** Supervised Learning Framework, concepts & hypothesis, Training & Learning, Boolean functions and formulae, Monomials, Disjunctive Normal Form & Conjunctive Normal Form, A learning algorithm for monomials **Practical:**						**CO1**

	• Building a Database Design using ER Modelling and Normalization Techniques • Implementation of functions, Procedures, Triggers and Cursors	
	Unit 2: (16 hours) • **Data Preparation:** Data Cleaning, Data Integration & Transformation, Data Reduction • **Mining Association Rules:** Associations, Maximal Frequent & Closed Frequent item sets, Covering Algorithms & Association Rules, Linear Models & Instance-Based Learning, Mining Association Rules from Transactional databases, Mining Association Rules from Relational databases & Warehouses, Correlation analysis & Constraint-based Association Mining **Practical:** ● Load Data from heterogeneous sources including text files into a predefined warehouse schema. ● Feature Selection and Variable Filtering (for very large data sets)	**CO2**
	Unit 3: (14 hours) • **Classification and Prediction:** Issues regarding Classification & Prediction, Classification by Decision Tree induction, Bayesian classification, Classification by Back Propagation, k-Nearest Neighbour Classifiers, Genetic algorithms, Rough Set & Fuzzy Set approaches **Practical:** ● Association mining in large data sets ● Interactive Drill-Down, Roll up, Slice and Dice operations	**CO3**
	Unit 4: (15 hours) • Mining Complex Types of Data: Multidimensional analysis & Descriptive mining of Complex data objects, Mining Spatial Databases, Mining Multimedia Databases, Mining Time-series & Sequence data, Mining Text databases, Mining World -Wide Web • Data Mining Applications and Trends in Data Mining: Massive Datasets/Text mining, Agent-Based Mining **Practical:** ● Generalized EM & k-Means Cluster Analysis ● General Classification	**CO4**
Reference Books:	**1.** M.H.Dunham, Data Mining: Introductory and Advanced Topics, Pearson Education **2.** Jiawei Han, MichelineKamber, Data Mining Concepts & Techniques, Elsevier	

	3. C. M. Bishop, Pattern Recognition and Machine Learning, Springer **4.** S. Theodoridis and K. Koutroumbas, Pattern Recognition, 4th Edition, Academic Press, 2009. **5.** Arun k. Pujari, Data Mining Techniques, Universities Press Private Limited	

In hours			
L	T	P	Credit
3	0	0	3

Course Code	**CST305**						
Course Title	**Software Engineering**						
Course Outcomes	On the completion of the course, the student will gain the following knowledge and skills CO1: Plan a software engineering process life cycle, including the specification, design, implementation, and testing of software systems that meet specification, performance, maintenance and quality requirements CO2: Able to elicit, analyse and specify software requirements through a productive working relationship with various stakeholders of the project CO3: Analyse and translate a specification into a design, and then realize that design practically, using an appropriate software engineering methodology. CO4: Know how to develop the code from the design and effectively apply relevant standards and perform testing, and quality management and practice CO5: Know how to manage the risks, ensures quality management and able to manage modern engineering tools.						
Examination Type	Theory						
Assessment Tools	Written Quiz	Assignment/Project Work	MSE	MSP	ESE	ESP	Attendance
Weightage	**10**	**10**	**25**		**50**		**5**
Examination Mode	Theory						
Syllabus	**Unit 1: (11hours)** • Introduction to Software Engineering: Software Problem, Software Engineering, Approach, Software process, Characteristics of Software Engineering Process, Software Applications, Software Crisis: Problem and Causes • Software Development Life Cycle: The waterfall model, Incremental process models, Evolutionary process models, Spiral Model. • Requirements engineering process: Feasibility studies, Requirements elicitation and analysis, Requirements validation, Requirements management						**CO1**
	Unit 2: (12hours) • **Software Requirements:** Functional and non-functional requirements, User requirements, System requirements, Interface specification, documenting Software Requirement Specification (SRS). • **Software Project Planning:** Cost estimation, cost estimation models, Project scheduling, Software Configuration management, Team Structure, Risk Management. • **System models:** Context Models, Behavioural models, Data models, Object models, structured methods • **Design Engineering:** Design Concepts, design models for architecture, component, data and user interfaces; Problem						**CO2**

	Partitioning, Abstraction, Cohesiveness, Coupling, Top Down and Bottom Up design approaches; Functional Versus Object Oriented Approach, Design Specification, 4GL	
	Unit 3: (12hours) • Creating an architectural design: Software architecture, Data design, Architectural styles and patterns, Architectural Design • Object-Oriented Design: Objects and object classes, An Object-Oriented design process, Design evolution. • Performing User interface design: Golden rules, User interface analysis and design, interface analysis, interface design steps, Design evaluation • Coding and Testing Strategies: Code reviews, A strategic approach to software testing, test strategies for conventional software, Black-Box and White-Box testing, Validation testing, System testing, the art of Debugging • Product metrics: Software Quality, Metrics for Analysis Model, Metrics for Design Model, Metrics for source code, Metrics for testing, Metrics for maintenance. • Metrics for Process and Products: Software Measurement, Metrics for software quality	**CO3**
	Unit 4: (11hours) • Risk Management: Reactive vs. Proactive Risk strategies, software risks, Risk identification, Risk projection and risk refinement • Quality Management: Quality concepts, Software quality assurance, Software Reviews, Formal technical reviews, Statistical Software quality Assurance, Software reliability, The ISO 9000 quality standards • CASE Tools: Types of CASE tools, advantages and components of CASE tools, Unified Modelling Language (UML)	**CO4**
	1. Software Engineering- K.K. Agarwal &Yogesh Singh, New Age International Publishers. **2.** Software Engineering, an Engineering Approach- James F. Peters, Witold Pedrycz, John Wiley. **3.** Software Engineering principles and practice- Waman S Jawadekar, The McGraw-Hill **4.** Software Engineering Approach, By R. S Pressman. **5.** Software Engineering, A practitioner's Approach- Roger S. Pressman, 6th edition. McGraw Hill International Edition. **6.** Software Engineering- Sommerville, 7th edition, Pearson education. **7.** An Integrated Approach to software Engineering. Pankaj Jalote	

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

Course Code	**CST307**						
Course Title	**Algorithm Design & Analysis**						
Course Outcomes	On the completion of the course, the student will gain the following knowledge and skills CO1: Describe the basic concepts of the algorithms and analyse the worst-case running times of algorithms using asymptotic analysis. CO2: Use divide-and-conquer techniques for solving suitable problems. CO3: Describe the greedy paradigm and explain when an algorithmic design situation calls for it. CO4: Apply dynamic programming and backtracking approaches to solve suitable problems. CO5: Able to Explain the major graph algorithms and Employ graphs to model engineering problems, when appropriate. Able to describe the classes P, NP, and NP-Complete. Practical: CO1: Identify the problem given and design the algorithm using various algorithm design techniques. CO2: Implement various algorithms in a high level language. CO3: Analyse the performance of various algorithms. CO4: Compare the performance of different algorithms for same problem.						
Examination Type	Theory + Practical						
Assessment Tools	Written Quiz	Assignment/Project Work	MSE	MSP	ESE	ESP	Attendance
Weightage	**10**	**-**	**25**	**-**	**35**	**25**	**5**
Examination Mode	Theory + Practical						
Syllabus	**Unit 1: (16 hours)** • **Introduction:** Concept of Algorithm, Role of Algorithms in Computing, Algorithm Specification, Performance Analysis (Time and space complexities), and Growth of functions: Asymptotic Notation, Standard notation & common functions; Introduction to Recurrences: substitution method, recursion-tree method, master method, Brute-Force, Branch and Bound, Randomizing Algorithms, Depth First Search (DFS) and Breadth First Search (BFS), Topological sorting. Divide and Conquer, General Method, Binary Search, Merge sort, Quick sort, Selection sort. **Practical:** ● Code and analyse to compute the greatest common divisor (GCD) of two numbers. ● Code and analyse to find the median element in an array of integers. ● Code and analyse to find the majority element in an array of integers.						**CO1**
	Unit 2: (16 hours)						**CO2**

	• **Greedy Algorithms:** Elements of Greedy strategy, Activity Selection Problem, Knapsack problem, Minimum Cost Spanning Trees (Prim's Algorithm, Kruskal's Algorithm), Single source Shortest paths problem and analysis of these problems. **Practical:** ● Code and analyse to find the edit distance between two character strings using dynamic programming. ● Code and analyse to find an optimal solution to matrix chain multiplication using dynamic programming.	
	Unit 3: (14 hours) • **Dynamic Programming:** Elements of dynamic programming, Assembly-line scheduling problem, Matrix-chain multiplication, Multistage Graph, All Pairs Shortest paths, Longest common subsequence, Bin Packing, 0/1 Knap Sack and Travelling Salesman Problem **Practical:** ● Code and analyse to do a depth-first search (DFS) on an undirected graph. ● Code and analyse to do a breadth-first search (BFS) on an undirected graph.	**CO3**
	Unit 4: (14 hours) **Back Tracking:** General method, 8 queen's problem, Graph coloring and Hamiltonian Cycles, 0/1 Knap Sack Problem, NP-Completeness ,Polynomial Time, polynomial-time verification, NP completeness &reducibility, NP-complete problems, Cook's theorem, Approximation algorithms. **Practical:** ● Code and analyse to find shortest paths in a graph with positive edge weights using Dijkstra's algorithm. ● Code and analyse to find shortest paths in a graph with arbitrary edge weights using Bellman-Ford algorithm. ● Code and analyse to find the minimum spanning tree in a weighted, undirected graph.	**CO4**
Reference Books:	**1.** M.H.Dunham, Data Mining: Introductory and Advanced Topics, Pearson Education **2.** Jiawei Han, MichelineKamber, Data Mining Concepts & Techniques, Elsevier **3.** C. M. Bishop, Pattern Recognition and Machine Learning, Springer **4.** S. Theodoridis and K. Koutroumbas, Pattern Recognition, 4th Edition, Academic Press, 2009. **5.** Arun k. Pujari, Data Mining Techniques, Universities Press Private Limited.	

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

Course Code	**CST315**						
Course Title	**SAP Fiori – Foundation**						
Course Outcomes							
Examination Type	Theory + Practical						
Assessment Tools	Written Quiz	Assignment/Project Work	MSE	MSP	ESE	ESP	ATTENDANCE
Weightage	**10**		**25**		**35**	**25**	**5**
Examination Mode	Theory + Practical						
Syllabus							
Reference Books:							

In hours			
L	T	P	Credit
1	0	2	2

Course Code	**CST317**						
Course Title	**Developing UIs with SAP UI5**						
Course Outcomes							
Examination Type	Theory + Practical						
Assessment Tools	Written Quiz	Assignment/Project Work	MSE	MSP	ESE	ESP	ATTENDANCE
Weightage	**10**		**25**		**35**	**25**	**5**
Examination Mode	Theory + Practical						
Syllabus							
Reference Books:							

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

Course Code	**CST340**						
Course Title	**Advanced SAP UI5 Development**						
Course Outcomes							
Examination Type	Theory						
Assessment Tools	Written Quiz	Assignment/Project Work	MSE	MSP	ESE	ESP	Attendance
Weightage	**10**	**10**	**25**	**0**	**50**	**0**	**5**
Examination Mode	Theory + Practical						
Syllabus							
Reference Books:							

In hours			
L	**T**	**P**	**Credit**
1	0	2	2

Course Code	**CST342**						
Course Title	**SAP Fiori Elements Development**						
Course Outcomes							
Examination Type	Theory + Practicala						
Assessment Tools	Written Quiz	Assignment/Project Work	MSE	MSP	ESE	ESP	Attendance
Weightage	**10**	**10**	**25**	**0**	**50**	**0**	**5**
Examination Mode	Theory + Practical						
Syllabus							
Reference Books:							

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

Course Code	**CST344**						
Course Title	**Developing SAP Fiori UIs**						
Course Outcomes							
Examination Type	Theory + Practical						
Assessment Tools	Written Quiz	Assignment/Project Work	MSE	MSP	ESE	ESP	Attendance
Weightage	**10**	**10**	**25**	**0**	**50**	**0**	**5**
Examination Mode	Theory + Practical						
Syllabus							
Reference Books:							

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

Course Code	**CST304**						
Course Title	**Big Data Analytics**						
Course Outcomes	On the completion of the course, the student will gain the following knowledge and skills: CO1: Understand the concepts of distributed file system CO2: Learn abstraction of hadoop environment CO3: Study the hadoop architecture CO4: Know the hadoop ecosystem and yarn components CO5: Learn different architecture like HIVE and HIVEQL, HBASE						
Examination Type	Theory						
Assessment Tools	Written Quiz	Assignment/Project Work	MSE	MSP	ESE	ESP	Attendance
Weightage	**10**	**10**	**25**	**0**	**50**	**0**	**5**
Examination Mode	Theory						
Syllabus	**Unit 1: (10hours)** • Introduction to Big Data: Overview of Big Data, Stages of analytical evolution, Challenges of Conventional Systems, Intelligent data analysis, Nature of Data, Analytic Processes and Tools, Analysis vs. Reporting, Modern Data Analytic Tools, Statistical Concepts: Sampling Distributions - Re-Sampling, Statistical Inference - Prediction Error						**CO1**
	Unit 2: (12hours) • Mining Data Streams: Introduction To Streams Concepts, Stream Data Model and Architecture, Stream Computing, Sampling Data in a Stream, Filtering Streams, Counting Distinct Elements in a Stream, Estimating Moments, Counting Oneness in a Window, Decaying Window, Real time Analytics Platform (RTAP) Applications						**CO2**
	Unit 3: (13hours) • Hadoop: History of Hadoop, The Hadoop Distributed File System, Components of Hadoop, Analysing the Data with Hadoop, Scaling Out- Hadoop Streaming, Design of HDFS-Java interfaces to HDFS Basics, Developing a Map Reduce Application, How Map Reduce Works, Anatomy of a Map Reduce Job run-Failures, Job Scheduling-Shuffle and Sort, Task execution, Map Reduce Types and Formats, Map Reduce Features						**CO3**

	Unit 4: (11hours) • Frameworks: Applications on Big Data Using Pig and Hive, Data processing operators in Pig Hive services, HiveQL, Querying Data in Hive, Fundamentals of HBase and Zookeeper, Visualizations: Visual data analysis techniques, interaction techniques. Systems and applications	**CO4**
Reference Books:	• Michael Berthold, David J. Hand, Intelligent Data Analysis, Springer, 2007. • Chris Eaton, Dirk DeRoos, Tom Deutsch, George Lapis, Paul Zikopoulos, Understanding Big Data: Analytics for Enterprise Class Hadoop and Streaming Data, 2012. • Tom White, Hadoop: The Definitive Guide Third Edition, O'reilly Media, 2012. • AnandRajaraman and Jeffrey David Ullman, Mining of Massive Datasets, Cambridge University Press, 2012. • Bill Franks, Taming the Big Data Tidal Wave: Finding Opportunities in Huge Data Streams with Advanced Analytics, JohnWiley& sons, 2012. • Michael Minelli (Author), Michele Chambers (Author), AmbigaDhiraj (Author), Big Data, Big Analytics: Emerging Business Intelligence and Analytic Trends for Today's Businesses,Wiley Publications, 2013. • Jiawei Han, MichelineKamber, Data Mining Concepts and Techniques, Second Edition, Elsevier, Reprinted 2008.	

In hours			
L	T	P	Credit
3	0	0	3

Course Code	**CST316**						
Course Title	**Machine Learning**						
Course Outcomes	On the completion of the course, the student will gain the following knowledge and skills: CO1: Develop an appreciation for what is involved in learning models from data CO2: Understand a wide variety of learning algorithms CO3: Understand how to evaluate models generated from data CO4: Apply the algorithms to a real problem, optimize the models learned and report on the expected accuracy that can be achieved by applying the models						
Examination Type	Theory						
Assessment Tools	Written Quiz	Assignment/Project Work	MSE	MSP	ESE	ESP	ATTENDANCE
Weightage	**10**	**10**	**25**	**0**	**50**	**0**	**5**
Examination Mode	Theory						
Syllabus	**Unit 1: (11hours)** • Introduction: Introduction to Machine Learning, Example Problems, Applications and its types. Characteristics of Machine learning tasks, Predictive and descriptive tasks, Machine learning Models, Features: Feature types, Construction and Transformation. Binary and Multiclass Classification, Assessing Classification performance, Class probability Estimation. • Supervised Learning: Training, Testing and Validation data, Data Cleaning-Handling Text and categorical attributes, Regression and its types, Cost Function, Gradient Descent-Batch, Stochastic, Mini-batch, Learning Curves, Support Vector Machines						**CO1**
	Unit 2: (11hours) • Dimensionality Reduction: Curse of dimensionality, Approaches- Projection, Manifold Learning, PCA Principal Components, Explained variance ratio, choosing number of dimensions, Kernel PCA. • Unsupervised Learning: Clustering- K-Means, Hierarchical, Objective function. Rule Based Models: Rule learning for subgroup discovery, Association rule mining						**CO2**
	Unit 3: (12hours) • Decision Tree Learning: Introduction, Decision Tree Representation, Appropriate problem for Decision						**CO3**

	tree Learning, The Basic Decision Tree Learning Algorithm, Hypothesis Space Search in Decision Tree Leaning, Inductive Bias in Decision Tree Leaning, Issues in Decision Tree Leaning. • Artificial Neural Networks: Introduction, Natural Network Representations, Appropriate Problems for Neural Network Learning, Perceptions, Multilayer Network and the BACKPROPAGATION Algorithm.	
	Unit 4: (12hours) • Bayesian Learning: Introduction, Bayes Theorem, Bayes Optimal Classifier, Native Bayes Classifier, An Example: Learning to Classify Text. • Instance-Based Learning: Introduction, K-NEAREST NEIGHBOUR Learning, Distance Weighted NEAREST NEIGHBOUR Algorithm. Genetic Algorithms: Motivation, Genetic Algorithms, Genetic Programming, Parallelizing Genetic Algorithms	**CO4**
Reference Books:	1. Yuxi (Hayden) Liu, "Python Machine Learning By Example", Packt 2. Allen Downey, Jeffrey Elkner and Chris Meyers, "How to Think Like a Computer Scientist, Learning with Python", Green Tea Press Wellesley, Massachusetts 3. David Longbow, "Machine Learning: A Beginners Guide to the Fundamentals of Machine Learning", Paperback	

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

Course Code	**CST322**						
Course Title	**New Age Technologies**						
Course Outcomes	On the completion of the course the student will be able to CO1: Obtain adequate knowledge about block chain CO2: Gain extensive knowledge about the cloud computing and services CO3: Understanding the importance of internet of things and its application CO4: Have Overview in data analysis and big data						
Examination Type	Theory						
Assessment Tools	Written Quiz	Assignment/Project Work	MSE	MSP	ESE	ESP	Attendance
Weightage	**10**	**10**	**25**		**50**		**5**
Examination Mode	Theory						
Syllabus	**Unit 1: (11hours)** **Block chain** • Introduction to Block chain: • Digital Money to Distributed Ledgers, • Design Primitives: Protocols, Security • Consensus, Permissions, Privacy. • Block chain Architecture and Design: • Basic crypto primitives: Hash, • Signature, Hash chain to Block chain, Bit coin Basic, • Basic consensus mechanisms.						**CO1**
	Unit 2: (12hours) **Cloud Computing & Edge Computing** • Introduction: Cloud Computing – • Definition of Cloud - Cloud Architecture • Types of Clouds - Business models around Clouds • Issues in Clouds – • Eucalyptus - Nimbus - Open Nebula, CloudSim. • Cloud Services: • Types of Cloud services: • Software as a Service Platform as a Service						**CO2**
	Unit 3: (12hours) **Internet of Things** • Getting Familiar with internet of Things (IoT): • Definition, Characteristics. Physical Design of IoT: • Things in IoT, IoT Protocols. • Logical Design of IoT: Functional block, • Communication Models and APIs, IoT Stack • Overview of Domain Specific						**CO3**

	• IoTs applications Like Smart Cities, Smart Agriculture and industrial IoT Applications. • Types of Sensors. integrating Sensors: HDT (Humidity and Temperature Sensor)	
	Unit 4: (12hours) **Data Science & Big Data** • Sources and nature of data, • Classification of data (structured, semi-structured, unstructured), need of data analytics • Evolution of analytic scalability, • Modern data analytic tools, applications of data analytics. • Introduction to Big Data: • Types of digital data, history of Big Data innovation, • Big Data privacy and ethics, • Big Data Analytics, • Challenges of conventional systems.	**CO4**
Reference Books:	• Big-Data Black Book, DT Editorial Services, Wiley. • Anthony T Velte, Toby J Velte, Robert Elsenpeter, "Cloud Computing : A Practical Approach", Tata McGraw-Hill 2010. • S. K. Vasudevan, A. S. Nagarajan, RMD Sundaram, "lnternet of Things", Wiley, 1st Edition, 2014. • David E.Y. Sarna, "Implementing and Developing Cloud Application", CRC press 2011. • V. Madlsetti, A. Bahga, "lnternet of Things: A Hands-on Approach", United Kingdom: Arsheep Bahga & Vijay Madisetti, 1st Edition, 2015.	

PROGRAM ELECTIVE-I

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

Course Code	**CST320**						
Course Title	**Software Project Management**						
Course Outcomes	On the completion of the course the student will be able to CO1: Understand Project Management principles while developing software. CO2: Gain extensive knowledge about the basic project management concepts, framework and the process models. CO3: Obtain adequate knowledge about software process models and software effort estimation techniques. CO4: Estimate the risks involved in various project activities. CO5: Define the checkpoints, project reporting structure, project progress and tracking mechanisms using project management principles.						
Examination Type	Theory						
Assessment Tools	Written Quiz	Assignment/Project Work	MSE	MSP	ESE	ESP	Attendance
Weightage	**10**	**10**	**25**		**50**		**5**
Examination Mode	Theory						
Syllabus	**Unit 1: (11hours)** • Importance of Software Project Management • Activities – Methodologies – Categorization of Software Projects – • Setting objectives – Management Principles • Management Control – Project portfolio Management • Cost-benefit evaluation technology • Risk evaluation – Strategic program Management • Stepwise Project Planning.						**CO1**
	Unit 2: (12hours) • Software process and Process Models • Choice of Process models • Rapid Application development – Agile methods • Dynamic System Development Method • Extreme Programming • Managing interactive processes • Basics of Software estimation • Effort and Cost estimation techniques • COSMIC Full function points – COCOMO II • A Parametric Productivity Model.						**CO2**
	Unit 3: (12hours) • Objectives of Activity planning • Project schedules – Activities • Sequencing and scheduling • Network Planning models • Formulating Network Model						**CO3**

	• Forward Pass & Backward Pass techniques • Critical path (CRM) method • Risk identification • Risk Planning • Creation of critical paths • Cost schedules.	
	Unit 4: (11hours) • Framework for Management and control • Collection of data – Visualizing progress • Cost monitoring • Earned Value Analysis • Prioritizing Monitoring • Project tracking, Change control • Software Configuration Management • Managing contracts	**CO4**
Reference Books:	1. Robert K. Wysocki —Effective Software Project Management – Wiley Publication, 2011. 2. Walker Royce: —Software Project Management-Addison-Wesley, 1998 3. Gopalaswamy Ramesh, —Managing Global Software Projects – McGraw Hill Education (India), Fourteenth Reprint 2013.	

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

Course Code	CST328						
Course Title	**Cognitive Computing**						
Course Outcomes	On the completion of the course the student will be able to CO1: Understand various concepts of cognitive computing CO2: Understand the hybrid earning with fuzzy CO3: implement machine earning techniques for cognitive computing CO4: Develop cognitive computing related applications, like Chabot and discuss case studies.						
Examination Type	Theory						
Assessment Tools	Written Quiz	Assignment/Project Work	MSE	MSP	ESE	ESP	ATTENDANCE
Weightage	**10**	**10**	**25**	**0**	**50**		**5**
Examination Mode	Theory						
Syllabus	**Unit 1: (12hours)** • Cognitive Computing, Cognitive Psychology, • The Architecture of the Mind, • The Nature of Cognitive Psychology, • Cognitive architecture, Cognitive processes, • The Cognitive Modelling Paradigms, • Declarative / Logic based Computational cognitive • Modelling, connectionist models • Bayesian models. • Introduction to Knowledge-Based AI • Human Cognition on AI – Cognitive Architectures						**CO1**
	Unit 2: (11hours) • Intelligent Decision making, • Fuzzy Cognitive Maps, • learning algorithms: Nonlinear • Hebbian Learning, • Data driven NHL, • Hybrid learning, • Fuzzy Grey cognitive maps, • Dynamic Random fuzzy cognitive Maps						**CO2**
	Unit 3: (12hours) • Machine learning Techniques for cognitive decision making, Hypothesis Generation and Scoring, • Natural Language Processing. • Representing Knowledge, • Taxonomies and Ontologies, N-Gram models, Application						**CO3**

	Unit 4: (12hours) • Cognitive Systems in health care • Cognitive Assistant for visually impaired • AI for cancer detection, • Predictive Analytics, • Text Analytics, Image Analytics, Speech Analytics • IBM Watson • Introduction to IBM's Power AI Platform • Introduction to Google's Tensor Flow Development Environment	**CO4**
Reference Books:	1. Hurwitz, Kaufman, and Bowles, "Cognitive Computing and Big Data Analytics", Wiley, Indianapolis. 2. Jerome R. Busemeyer, Peter D. Bruza, "Quantum Models of Cognition and Decision", Cambridge University Press. 3. Emmanuel M. Pothos, Andy J. Wills, "Formal Approaches in Categorization", Cambridge University Press. 4. Nils J. Nilsson, "The Quest for Artificial Intelligence", Cambridge University Press. 5. Neil Stillings, Steven E. Weisler, Christopher H. Chase and Mark H. Feinstein, "Cognitive Science: An Introduction", MITPress.	

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

Course Code	**CST334**						
Course Title	**R for Data Science**						
Course Outcomes	After successfully completing this course the students will be able to CO1: Explain the fundamental concepts associated with programming in R including functions, variables, data types, pipes, and vectors. CO2: Describe the options for generating visualizations in R. CO3: Understanding Statistical analysis, regression, etc. CO4: Understanding prescriptive analysis and reinforcement learning.						
Examination Type	Theory						
Assessment Tools	Written Quiz	Assignment/Project Work	MSE	MSP	ESE	ESP	Attendance
Weightage	**10**	**10**	**25**		**50**		**5**
Examination Mode	Theory						
Syllabus	**Unit 1: (13hours)** Introduction to Data Analysis Overview of Data Analytics, Need of Data Analytics, Nature of Data, Classification of Data: Structured, Semi-Structured, Unstructured, Characteristics of Data, Applications of Data Analytics. Overview of R programming, Environment setup with R Studio, R Commands, Variables and Data Types, Control Structures, Array, Matrix, Vectors, Factors, Functions, R packages.						**CO1**
	Unit 2: (11hours) Data Visualization using R Reading and getting data into R (External Data): Using CSV files, XML files, Web Data, JSON files, Databases, Excel files. Working with R Charts and Graphs: Histograms, Boxplots, Bar Charts, Line Graphs, Scatterplots, Pie Charts						**CO2**
	Unit 3: (12hours) Statistics with R Random Forest, Decision Tree, Normal and Binomial distributions, Time Series Analysis, Linear and Multiple Regression, Logistic Regression, Survival Analysis						**CO3**
	Unit 4: (11hours) Prescriptive Analytics: Creating data for analytics through designed experiments, Creating data for analytics through active learning, Creating data for analytics through reinforcement learning						**CO4**
Reference Books:	• An Introduction to R, Notes on R: A Programming Environment for Data Analysis and Graphics. W. N. Venables, D.M. Smith and the R Development Core Team.						

	Version 3.0.1 (2013-05-16). URL: https://cran.r-project.org/doc/manuals/r-release/R-intro.pdf • Jared P Lander, R for everyone: advanced analytics and graphics, Pearson Education, 2013 • Dunlop, Dorothy D., and Ajit C. Tamhane. Statistics and data analysis: from elementary to intermediate. Prentice Hall, 2000. • G Casella and R.L. Berger, Statistical Inference, Thomson Learning 2002. • P. Dalgaard. Introductory Statistics with R, 2nd Edition. (Springer 2008)	

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

Course Code	**CST324**						
Course Title	**Digitizing Industry Knowledge for Software Development**						
Course Outcomes	On the completion of the course the student will be able to CO1: Obtain adequate knowledge about block chain CO2: Gain extensive knowledge about the cloud computing and services CO3: Understanding the importance of internet of things and its application CO4: Have Overview in data analysis and big data						
Examination Type	Theory						
Assessment Tools	Written Quiz	Assignment/Project Work	MSE	MSP	ESE	ESP	Attendance
Weightage	**10**	**10**	**25**		**50**		**5**
Examination Mode	Theory						
Syllabus	**Unit 1: (11hours)** • Problem Space Understanding and industry overview • Industry Overview, Types of industries, IT overview • IT company- objectives, organization structures and stakeholders. • Project team and stakeholders. • Domain Knowledge Framework (DKF) - Introducing science to the art of learning domains.						**CO1**
	Unit 2: (12hours) • Insurance, Reinsurance and retrocession. • Specialized IT applications of insurance. • Insurance domain knowledge-Sprinklers. • Banking, KYC, Specialized IT applications of banking • Banking domain knowledge-Sprinklers.						**CO2**
	Unit 3: (12hours) • Evolution of automobile industry • Specialized IT applications of automobiles. • Automobile domain knowledge-Sprinklers • Some other domains and reflections on skill development- Agriculture, Manufacturing industry, service industry, knowledge based industry						**CO3**
	Unit 4: (12hours) • DKF in horizontal domains • DKF in skill development • Automatic knowledge model(AKM)- delivering IT projects reusing industry knowledge • Digital Transformation and the role of KDD						**CO4**

Reference Books:	• Digitizing Industry Knowledge for Software Development Hardcover – 5 May 2023 by Manoj Kumar Lal • Knowledge Driven Development: Bridging Waterfall and Agile Methodologies by Manoj Kumar Lal	