Bachelor of Technology
in
Fire & Environment,Health, Safety

July 2020

GSFC University, Fertilizer Nagar
Vadodara- 391750

Bachelor of Technology (B. Tech.) in Fire & Environment, Health, Safety (F& EHS)

Code	Course Title	L-T-P	C		Code	Course Title	L-T-P	C
I Semester					**II Semester**			
BTEC101	Basics of Electrical & electronics	3-0-2	4		BTEC201	Engineering Fundamentals	3-0-0	3
BTMA102	Mathematics – I	3-1-0	4		BTME202	Engineering Graphics	3-0-2	4
BTCS103	Computer Programming-I	3-0-2	4		BTMA203	Mathematics - II	3-1-0	4
BTPY104	Engineering Physics	3-0-2	4		BTME204	Engineering Mechanics	4-0-2	5
BTME105	Workshop	0-0-2	1		BTCY205	Engineering Chemistry	3-0-2	4
BTFS106	Fundamental in Fire & Environment,health,Safety	2-0-0	2		BTCS206	Computer Programming II	0-0-2	1
					BTME207	AutoCAD	0-0-2	1
	Total	**23**	**19**			**Total**	**27**	**22**
III Semester					**IV Semester**			
C301	Mathematics – III	3-1-0	4		20BTFS401	Rescue techniques & equipments	2-0-2	3
20BTFS301	Safety management - 1	3-0-0	3		20BTFS402	Building Fire Prevention &Protection measures	3-0-2	4
20BTFS302	Legislations related to Fire & EHS	3-0-0	3		20BTFS403	Hazard Identification,Risk assesment & Control techniques	3-1-0	4
20BTFS303	Town Planning & Building Design	3-0-2	4		20BTFS404	Safety in Construction Industry	3-0-0	3
20BTFS304	Strength of Materials	3-0-2	4		20BTFS405	Machine Design	3-1-0	4
20BTFS305	Automobile engg & Safety	3-0-0	3		20BTFS406	Fluid mechanics & Pumping machinery	3-0-2	4
	Case studies & Seminar	2-0-0	1			Fire Ground Practicals -1	0-0-2	1
	Total	**27**	**18**			**Total**	**27**	**23**
V Semester					**VI Semester**			
20BTFS501	Fire Service operations	3-0-2	4		20BTFS601	Safety engineering in Industrial applications	3-0-0	3
20BTFS502	Safety Management - 2	3-0-0	3		20BTFS602	Fire fighting & safety codes & standards	3-0-0	3
20BTFS503	Electrical Technology & Safety	3-1-0	4		20BTFS603	Fire Protection systems -1	3-0-2	4
20BTFS504	Occupational Health & first aid	3-0-2	4		20BTFS604	Fire & Safety Hazards in special sectors (Aviation, Marine, Nuclear)	3-0-2	4
20BTFS505	Fire safety in refinery, petrochemical,fertilizer & chemical Industry	3-0-0	3		20BTFS605	Professional Elective –I (Even)	3-0-0	3
20BTFS506	Introduction of fire dynamics	3-0-2	4		OE-1	Open Elective	3-0-0	3
	Fire ground Practicals-2	0-0-2	1			Audits & Seminar	2-0-0	1
	Total	**27**	**23**			**Total**	**24**	**21**
VII Semester					**VIII Semester**			
20BTFS701	Fire Protections sysems -2	3-0-2	4		20BTFS801	Structural Behaviour & Passive Fire Protection	3-0-0	3
20BTFS702	Chemical safety covering various	3-0-0	3		20BTFS802	Environmental Impact Assesment & waste	4-0-0	4

	types of Industries					Management		
20BTFS703	Management & Entrepreneuship development	4-0-0	4		20BTFS803	Major BtechProject	0-0-16	8
20BTFS704	Industrial Hygiene, applied Ergononmics &Occupational Health	4-0-0	4					
20BTFS705	Professional Electives	3-0-0	3			**Total**	**7**	**15**
	Total	**19**	**18**					
Grand Total							**195**	**165**

First Semester

SEMESTER 1 – COMMON FOR ALL BRANCHES													
Sr No	Course Code	Course Name	TEACHING SCHEME					EXAM SCHEME					
								THEORY MARKS			PRACTICAL		
			L	T	P	C	Hrs/ week	CE	MID SEM	END SEM	LAB WORK	LAB EXAM	TOTAL
1	BTEC101	Basic of Electrical & Electronics	3	0	2	4	5	20	50	30	25	25	150
2	BTMA102	Mathematics - I	3	1	0	4	4	20	50	30	--	--	100
3	BTCS103	Computer Programming-I	3	0	2	4	5	20	50	30	25	25	150
4	BTPY104	Engineering Physics	3	0	2	4	5	30	50	20	25	25	150
5	BTME105	Workshop	0	0	2	1	2	30	50	20	25	25	50
6	BTFS106	Fundamentals of Fire & Environment, Health,Safety	2	0	0	2	2	30	50	20	--	--	100
		Total	**14**	**1**	**8**	**19**							**700**

MS - Mid Semester, ES - End Semester, CE - Continuous Evaluation, LW - Laboratory Work, LE - Laboratory Exam

BTEC101	BASICS OF ELECTRICAL AND ELECTRONICS	L	T	P	C
		3	0	2	4
Total Credits:4	**Total Lecture & Practical Hours in semester :45hrs +30hrs**		**Total Marks:100**		

1	**Course Pre-requisites: Nil**
2	**Course Category: Core Courses**
3	**Course Revision/ Approval Date:23rd June 2020**

4. **Course Objectives :**

1	Impart a basic knowledge of electrical quantities such as current, voltage, power,energy and frequency to understand the impact of technology in a global and societal context.
2	Provide working knowledge for the analysis of basic DC and AC circuits used in electrical and electronic devices.
3	To explain the working principle, construction, applications of DC machines, AC machines & measuring instruments.
4	Highlight the importance of transformers in transmission and distribution of electric power.
5	To understand the laws of electrical engineering.

Course Content	Weightage	Contact hours	Pedagogy
Theory: Electrical Engineering Study of voltage, current, power & energy. Application of Ohm's law, Kirchhoff's law, Lenz law.Electromagnetic induction through working of a transformer. **Practical: (Symbols of Electrical and Electronics equipment, Basics of Electrical safety & Study of Electrical Safety rules)**	25%	10 hours	Presentation, Video presentation

Unit 2:Theory: Concept of 1-phase, 3- phase AC supply. Introduction of terms like RMS value, average value. Familiarity with components like resistors, capacitors, diodes, LED's, their application, uses, industrial specification. Introduction to component data sheets. **Practical: (Patch cords, Digital Multimeter (DMM), Familiarization with Digital multi-meter (DMM))**	25%	10 hours	Presentation, Video presentation
Unit 3:Theory: Electrical Machines Understanding the construction, type, principle of operation of various motors like DC, Stepper, Servo, AC. Introduction to the concepts of motor selection and sizing. **Practical: (Measurement of AC Voltage at 230 V AC Mains plug, Measurement of DC Voltage for cell phone battery of 3.8 V DC, Measurement of Resistance of Current coil & Potential coil of Energy meter,Measurement of Continuity of any wire/fuse.)**	25%	10 hours	Presentation, Video presentation
Unit 4: Theory: Electronics Engineering Introduction of electronic components like diodes, LED's, transistors, OpAmps, Gates Industrial specification and data sheets of the components. Characteristics and usage of the components. Signals: Analog & Digital. Introduction to industrial data acquisition **Practical: (Study the basics of 1-phase control transformer & verify its turn-ratio, Familiarization with Digital Storage Oscilloscope (DSO).)**	20%	10 hours	Presentation, Video presentation
Unit 5: **Test Equipment** Theory: Test Equipment Introduction to Multimeter and Oscilloscope **Practical: (Understand the construction & working of energy meter, Load Test on 1 Phase AC CSCR Type AC Motor, Load Test on DC Shunt Motor.)**	10%	5 hours	Presentation, Video presentation

LEARNING RESOURCES

TEXTBOOKS	1.Albert Paul Malvino," Electronic Principles", Tata Mcgraw Hill,2002

REFERENCE BOOKS	1.SimonHaykin, “Communication Systems”, Wiley Eastern, Third Edition,19
Journals & Periodicals:	**NIL**
Other Electronic Resources:	NIL

Evaluation Scheme	**Total Marks 100 marks**	
Mid semester Marks	30 marks	
End Semester Marks	50 marks	
Continuous Evaluation Marks (20 Marks)	**CATEGORY**	**MARKS**
	Attendance	5 MARKS
	Quiz	5 MARKS
	Skill enhancement activities / case study	5 MARKS
	Presentation/ miscellaneous activities	5 MARKS

Course Outcomes	Predict the behavior of any electrical and magneticcircuits
	Formulate and solve complex AC, Dc circuits.
	Identify the type of electrical machine used for that particular application.
	Realize the requirement of transformers in transmission and distribution of electric power and other applications.
	Function on multi-disciplinary teams.

BTMA102	MATHEMATICS-I	L	T	P	C
		3	1	0	4
Total Credits:4	**Total Hours in semester :45 hrs+15hrs Tutorial**		**Total Marks:100**		

1	**Course Pre-requisites:** Differentiation and Integration (Basic calculus),Trigonometry
2	**Course Category: Core Courses**
3	**Course Revision/ Approval Date:23rd June 2020**

4. **Course Objectives :**

1	Gives a clear understanding of the ideas of calculus as a solid foundation for subsequent courses in mathematics and other disciplines
2	Comprehensive focus on teaching calculus based on concepts as well as procedures
3	Enables students to apply their knowledge and solve practical problems in physical sciences and engineering.
4	understanding basic concepts of linear algebra (systems of linear equations, matrix calculus, vectors and basic vector operations)
5	solving computational problems of linear algebra

Course Content	Weightage	Contact hours	Pedagogy
Unit 1-Theory: Review of limits, continuity, and differentiability of function of single variable; indeterminate forms and L'Hospitals Rule.	20%	7 hours	Presentation, Video presentation
Unit 2:Theory: Sequences and series, Tests for convergence of series (nth term, Comparison, limit comparison, Ratio, Root, Integral, Geometric series, Alternating series), Power Series, Taylor Series, Maclaurin's Series.	20%	10 hours	Presentation, Video presentation

Unit 3:Theory: Partial Derivatives: Limit and continuity of functions of two variable, chain rule, total derivatives, Taylor's series expansion of function of two variables.	20%	10hours	Presentation, Video presentation
Unit 4:Theory: Applications of Partial Derivatives:Maxima and minima, Lagrange multipliers, errors and approximation, implicit functions, tangent plane and normal to a surface.	20%	8 hours	Presentation, Video presentation
Unit 5:Theory: Linear Algebra:Elementary operations and their use in getting the Rank, Inverse of a matrix and solution of linear simultaneous equations.Orthogonal,Symmetric, Skew-symmetric,Hermitian,Skew-Hermitian,Normal&Unitary matrices and their elementary properties. Characteristicpolynomials,Eigen- values and Eigenvectors of a matrix, CayleyHamiltontheorem(without proof) and its use in finding inverse of a matrix. Applications of Matrices.	20%	10 hours	Presentation, Video presentation

LEARNING RESOURCES

TEXTBOOKS	1. Veerarajan T., Engineering Mathematics for first year, Tata McGraw-Hill,New Delhi, 2008.
REFERENCE BOOKS	1. Thomas, G.B., Finney, R.L., Calculus and Analytic Geometry, 9th Ed.,Wesley/Narosa, (1998).
Journals & Periodicals:	**NIL**
Other Electronic Resources:	NIL

Evaluation Scheme	**Total Marks 100 marks**

Mid semester Marks	30 marks	
End Semester Marks	50 marks	
Continuous Evaluation Marks (20 Marks)	**CATEGORY**	**MARKS**
	Attendance	5 MARKS
	Quiz	5 MARKS
	Skill enhancement activities / case study	5 MARKS
	Presentation/ miscellaneous activities	5 MARKS
Course Outcomes	Apply the concepts of limits, continuity and derivatives to solving problems.	
	Determine convergence or divergence of sequences and series	
	Use Taylor and MacLaurin series to represent functions. Solve application problems.	
	Understand functions of several variables, limits, continuity, partial derivatives. Identify and solve some system of linear equations.	
	To deal with functions of several variables that is essential in most branches of engineering. The essential tool of matrices and linear algebra in a comprehensive manner.	

BTCS103	COMPUTER PROGRAMMING-I	L	T	P	C
		3	0	2	4
Total Credits:4	**Total Lecture Hours in semester :45 hrs + 30hrs**		**Total Marks:100**		

1	**Course Pre-requisites:** Nil
2	**Course Category: Core Courses**
3	**Course Revision/ Approval Date:23rd June 2020**

4. **Course Objectives :**

1	This course is designed to provide complete knowledge of C programming.
2	Students will be able to develop logics which will help them to create programs,applications in C
3	Basic concepts of C will help students to learn any other programming language.

Course Content	Weightage	Contact hours	Pedagogy
Unit 1: BASICS OF C PROGRAMMING **Theory:** Introduction to programming paradigms - Structure of C program - C programming: Data Types, Storage classes, Constants, Enumeration Constants, Keywords, Operators: Precedence and Associativity, Expressions, Input / Output statements, Assignment statements, Decision making statements, Control structures, Pre- processor directives, Compilation process. **Practical:** 1. Program to print “Hello GSFC University”.	20%	15 hours	Chalk board Notes

2. Program to find the sum of the 2 numbers. 3. Program to find area and circumference of the circle. 4. Program to find simple interest. 5. Program to convert degree centigrade to Fahrenheit. 6. Program to calculate sum of 5 objects and print average. 7. Program to show swapping of 2 numbers without using third variable. 8. Program to show swapping of 2 number using third variable. B. Control Structures: IF, Switch, Loops 9. Program to show reverse of given number. 10. Program to find greatest among 3 numbers. 11. Repeat program 10 with conditional operator. 12. Program to find that entered year is Leap year or not. 13. Program to find given number is even or odd. 14. Program to use Switch statement,Display percentage of student. 15. Program to display arithmetic operation using Switch. 16. Program to display first 15 natural numbers and their sum using For Loop. 17. Program to print Patterns: 18. Program to print Fibonacci series till 40. 19. Program to find factorial of given number. 20. Program to find whether agiven number is prime or not.			

Unit 2: ARRAYS AND STRINGS **Theory:**Introduction to Arrays: Declaration, Initialization, One dimensional array, Two dimensional arrays, Addition, Scaling, Determinant and Transpose, String operations: length, compare, concatenate, copy, bubble sort, linear and binary search. **Practical:** 21. Program to create an array of 10 elements. Show the sum and average of 10 elements entered by the user. 22. Program to find maximum number in given Array. 23. Program to display matrix. 24. Program to find sum of two Matrices. 25. Program to find subtraction of two matrices. 26. Program to find multiplication of two matrices. 27. Write a program to read a series words using scanf(). 28. Write a program to copy one string into another and count the number of characters copied. 29. Write a program to concatenate strings. 30. Write a program to demonstrate String handling functions	20%	15hours	Chalk board Notes
Unit 3: FUNCTIONS AND POINTERS **Theory:** Introduction to functions: Function prototype, function definition, function call, Built-infunctions (string functions, math functions), Recursion, Pointer, pointer operators, Pointer arithmetic: Arrays and pointers, Array of pointers, Parameter passing: Pass by value, Pass by reference **Practical:** 31. Program for swapping of two numbers using functions. 32. Program to find factorial of given number using function. 33. Program to show table of given number using function. 34. Program to show call by value. 35. Program to show call by reference. 36. Program to find the largest among two using functions. 37. Write a program to show how similar name variables can be used in different functions. 38. Write a program to return more than one value from a function. 39. Program for passing array from main function to display function. 40. Write a program in C to show the basic declaration of pointer. 41. Write a program in C to demonstrate how to	20%	15 hours	Chalk board Notes

handle the pointers in the program. 42. Write a program in C to demonstrate the use of &(address of) and *(value at address) operator. 43. Write a program in C to add two numbers using pointers. 44. Write a program in C to add numbers using call by reference. 45. Write a program in C to store n elements in an array and print the elements using pointer. 46. Write a program in C to swap elements using call by reference. 47. Write a program in C to compute the sum of all elements in an array using pointers.			
Unit 4:STRUCTURES **Theory:**Structure: Nested structures, Pointer and Structures, Array of structures, Self-referential structures, typedef,Dynamic memory allocation,malloc, clloc, realloc, free() **Practical:** 48. Write a program to demonstrate declaration of structures. 49. Write a program to store student information using Structure. 50. Write a program to add two distances. 51. Write a program to store 10 student's information using structures. 52. Write a program to demonstrate nested structures. 53. Write a program to demonstrate how pointers will be used to create and access structures.	20%	15 hours	Chalk board Notes
Unit 5: FILE PROCESSING Theory:Files and file handling operations, Types of file processing: Sequential access, Random access, Sequential access file, Command line arguments. Practical: 54. Write a program to create a file and store information. 55. Write a program to read contents from a file. 56. Write a program to append content at the end of file. 57. Write	20%	15 hours	Chalk board Notes

a program to find the size of a file using file handling functions. 58. Write a program to update the contents of a file.			

LEARNING RESOURCES

TEXTBOOKS	1. Programming in ANSI C, 7th Edition by Balaguruswamy 2. C Programming: Test Your Skills, 1/e by Ashok Kamthane
REFERENCE BOOKS	1. Let Us C,16th Edition, by YashwantKanetkar 2. Programming with C, 2nd Edition by Gottfried, McGraw-Hill. 3. Understanding Pointers in C, 5th edition by YashwantKanetkar
Journals & Periodicals:	**NIL**
Other Electronic Resources:	**NIL**

Evaluation Scheme	**Total Marks 100 marks**	
Mid semester Marks	30 marks	
End Semester Marks	50 marks	
Continuous Evaluation Marks (20 Marks)	**CATEGORY**	**MARKS**
	Attendance	5 MARKS
	Quiz	5 MARKS
	Skill enhancement activities / case study	5 MARKS

	Presentation/ miscellaneous activities	5 MARKS
Course Outcomes	Students will be able to develop applications using C programming.	
	Students will gain basic understanding of good programming techniques, and would be able to create and run programs for engineering applications.	

BTPY 104	**ENGINEERING PHYSICS**	**L**	**T**	**P**	**C**
		3	**0**	**2**	**4**
Total Credits:4	**Total Hours in semester :45hrs + 30 hrs**		**Total Marks:100**		

1	**Course Pre-requisites: Nil**
2	**Course Category: Core Courses**
3	**Course Revision/ Approval Date:23rd June 2020**
4.	**Course Objectives :**
1	To familiarize with basics of Noise, Vibrations and Oscillations
2	To inculcate fundamental knowledge of Electromagnetism and its engineering applications
3	To develop basic understanding for different applications of optical phenomena
4	To embrace optical technologies and understand their functioning
5	To familiarize with introductory quantum physics and its importance

Course Content	**Weightage**	**Contact hours**	**Pedagogy**

Unit 1: Noise and Vibrations **Theory:** Concept of Noise and its sources. Noise Terminology. Definition of Harshness, acceptable levels and perception. Sources of Vibrations. Simple harmonic motion. Damped harmonic oscillator and its energy decay, Quality factor. Forced harmonic oscillator and its steady-state motion. Power absorbed by oscillator. Resonance. Analogy between electrical and mechanical oscillations. Mathematical modeling of vibrations. **Practical:** 1) To determine the frequency of vibrations on a string using Melde's experiment 2) To determine the frequency of the A.C. mains source using a Sonometer	25%	12 +06 hours	Presentation, Video presentation
Unit 2: Electromagnetism **Theory:** Laws of Electrostatics. Polarization and corresponding classification of materials. Permittivity and Dielectric constants. Laws of Magnetostatics. Magnetization and corresponding classification of materials, Permeability and susceptibility. Hysteresis. Maxwell's equations. Continuity equation. **Practical:** 1) To determine magnetic hysteresis properties of ferromagnetic materials. 2) To find the horizontal component of earth's magnetic field using tangent galvanometer (Virtual Lab). 3) To determine the magnetic dipole moment of a bar magnet and horizontal intensity of earth's magnetic field using a deflection magnetometer. To study the variation in magnetic field with distance along the axis of rotation of a circular coil.	20%	9+6 hours	Presentation, Video presentation

Unit 3: Modern Optics - I **Theory:** Superposition of waves and Interference. Concept of Diffraction and types of Diffraction. Fraunhofer diffraction of single and multiple slits. Types and applications of Diffraction gratings. Bragg's law. **Practical:** 1) To determine the wavelength of Monochromatic source using diffraction gratings. 2) To determine the dispersive power of a grating. 3) To determine wavelength of light using Newton's rings setup. 4) To determine refractive index of liquids using Newton's Ring (Virtual Lab)	20%	9+8 hours	Presentation, Video presentation
Unit 4: Modern Optics - II **Theory:** Concept of Polarization and types of Polarization. Polarization using reflection, double refraction, and scattering. Optical activity. Concept of Lasers, working and different types of Lasers, safety aspects, using lasers as sensors. **Practical:** **1.** 1) To determine the specific rotation of sugar using polarimeter (using setup/virtual lab).	20%	7 +4 hours	Presentation, Video presentation
Unit 5: Quantum Physics **Theory:** Black body radiation and concept of Photons, Photoelectric effect, de Broglie hypothesis, wave-particle duality, Interpretation of wave-function, Uncertainty relations, Schrodinger's wave-equation, Particle in a box. **Practical:** 1) To determine Planck's constant using photoelectric effect setup. **1.** To determine work function of the given material using photoelectric effect setup.	20%	8+6 hours	Presentation, Video presentation Chalk board Notes
LEARNING RESOURCES			

TEXTBOOKS	1. VIBRATIONS AND WAVES by George C. King, Willey (For Unit 1) 2. Engineering Physics by H K Malik and A K Singh, Tata McGraw-Hill Education (For All Unit 2, 3 and 4)
REFERENCE BOOKS	1. A Textbook of Engineering Physics by M N Avadhanulu, S CHAND 2. Textbook of Engineering Physics by Dr. P. S. Aithal and Dr. H. J. Ravindra, ACME Learning 3. ENGINEERING PHYSICS by S K Nayak and K.P. Bhuvana, Tata McGraw-Hill Education
Journals & Periodicals:	4. Journal of Applied Physics, AIP Publication, ISSN: 0021- 8979 (print) 1089-7550 (Online) **5.** Journal of Engineering Physics and Thermophysics, SPRINGER Publication, ISSN: 1062-0125 (Print) 1573-871X (Online) **6.** Current Applied Physics, ELSEVIER Publication, ISSN: 1567-1739 (Print) 1567-1739 (Online)
Other Electronic Resources:	**NIL**

Evaluation Scheme	**Total Marks 100 marks**	
Mid semester Marks	30 marks	
End Semester Marks	50 marks	
Continuous Evaluation Marks (20 Marks)	**CATEGORY**	**MARKS**
	Attendance	5 MARKS
	Quiz	5 MARKS
	Skill enhancement activities / case study	5 MARKS
	Presentation/ miscellaneous activities	5 MARKS
	• Understanding of the basic knowledge of harmonic motions.	
	• Conceptualization of different electric and magnetic properties of materials	
	• Understanding different engineering applications of optical fundamentals.	

Course Outcomes	• Conceptualization of construction and working of lasers • To embrace the concept of the quantum physics and have basic understanding of its principles.

BTME105	**ENGINEERING WORKSHOP PRACTICES**	**L**	**T**	**P**	**C**
		0	**0**	**2**	**1**
Total Credits:1	**Total Hours in semester : 30 hrs**		**Total Marks:50**		

1	**Course Pre-requisites: Zeal to learn the subject**
2	**Course Category: Skill Enhancement Courses**
3	**Course Revision/ Approval Date:23rd June 2020**

4. **Course Objectives :**

1	To give basic training on fitting, carpentry, sheet metal, machine shop, and black smithy.
2	To enable students to understand and practice joining techniques.
3	To train students to handle various machine tools.
4	To enable students to understand basic mechanical engineering concepts.
5	To enable students to fabricate components with their own hands.

Course Content	Weightage	Contact hours	Pedagogy
Unit 1:Introduction **Theory:** Introduction, Workshop layout, Importance of various sections/shops of workshop, Types of jobs done in each shop. General safety rules and work procedure in workshop. Measuring Instruments.	20%	6 hours	Hands on activities/ Job preparations

Practical: 1. Introduction to Engineering Workshop. Know general safety rules and work procedure of engineering workshop. 2. Sketch the layout of engineering workshop. Study the different shops and types of jobs done in each shop of engineering workshop. 3. Study about basic Measuring Instruments used in workshop.			
Unit 2: Welding **Theory:** Overview of arc and spot welding operations. **Practical:** 1. Study of **Arc welding machine and its accessories.** 2. Demonstrate and perform job by using **Arc welding machine.**	20%	4 hours	Hands on activities/ Job preparations
Unit 3: Fitting **Theory:** Overview of fitting operations **Practical:** 1. Study of **Fitting tools.** 1. Demonstrate and perform job by using **Fitting tools**.	20%	4 hours	Hands on activities/Job preparations
Unit 4:Black smithyTheory: Overview of smithy processes Practical: 1. Study of **Black smithy tools.** 2. Demonstrate and perform job by using **Black smithy tools**. 3. Study of **Tinsmithy tools**. 4. Demonstrate and perform job by using **Tinsmithy tools**.	20%	8 hours	Hands on activities/Job preparations

Unit 5: Machining-Theory: Overview of Lathe and shaper machines. **Practical:** 1. Study of **Lathe machine**. 2. Demonstrate different operations on **Lathe machine**. **3.** Study of **Shaper machine**. **4.** Demonstrate different operations on **Shaper machine**.	20%	8 hours	Hands on activities/Job preparations

LEARNING RESOURCES

TEXTBOOKS	1. HajraChoudhary, S. K., Elements of Workshop Technology, Media Promotors& Publishers Pvt. Ltd, 12thEdition, (2002). 2. Chapman, W.A.J., Workshop Technology, ELBS Low PriceText, Edward Donald Pub. Ltd., (1961).
REFERENCE BOOKS	1. Singh, D.K., Fundamentals of Manufacturing Engineering, Ane Books Pvt. Ltd, New Delhi, 2nd Edition, (2009). 2. Raghuwanshi, B.S., Course in Workshop Technology, DhanpatRai& Sons, New Delhi, (1991). 3. Schey, J.A., Introduction to Manufacturing Process, 3rd.Edition, McGraw Hill, (2000).
Journals & Periodicals:	1. Journal of Manufacturing Processes **2.** Procedia Manufacturing **3.** Manufacturing Letters
Other Electronic Resources:	1. http://www.weldingtechnology.org 2. http://www.piehtoolco.com/ 3. http://sourcing.indiamart.com/engineering/articles/materials-used-hand-tools/

Evaluation Scheme	**Total Marks 100 marks**
Mid semester Marks	nil

End Semester Marks	50 marks	
Continuous Evaluation Marks (20 Marks)	**CATEGORY**	**MARKS**
	Attendance	5 marks
	Quiz	nil
	Skill enhancement activities / case study	45 marks
	Presentation/ miscellaneous activities	nil
Course Outcomes	Upon completion of this laboratory course, students will be able to read and use a manufacturing drawing as a definition for the manufacturing of a part.	
	Able to fabricate components with their own hands.	
	Able to fabricate components with their own hands.	
	Will also get practical knowledge of the dimensional accuracies and dimensional tolerances possible with different manufacturing processes.	
	By assembling different components, they will be able to produce small devices of their interest.	

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BTFS108	FUNDAMENTALS OF FIRE, SAFETY, HEALTH &ENVIRONMENT	L	T	P	C
		2	0	0	2
Total Credits:2	**Total Hours in semester :30**		**Total Marks:100**		

1	**Course Pre-requisites: None**
2	**Course Category: Core Courses**
3	**Course Revision/ Approval Date:23rd June 2020**

4. **Course Objectives :**

1	Understand the fire, safety, health and environment challenges in built and industrial environment and approaches to addressing the same.
2	Become aware of important past incidents causing major loss of life & property and damage to environment, and their impact with respect to safety legislation and environment
3	History and current role of Fire & EHS related legislation and role of agencies involved with implementation.
4	Understand approaches for addressing fire and EHS challenges in the industrial environment.
5	Become familiar with current fire & safety engineering and management concepts and practices followed in the industry.

Course Content	Weightage	Contact hours	Pedagogy
Unit 1:Theory: Challenges to safety in built environment, types of hazards likely to cause harm (fire, burns, electric shock, falls), natural disasters, fatalities involving hazardous environments. Important Case studies involving major incidents and their subsequent effect on safety outlook. Approach to addressing Fire & EHS challenges at organization and national level.	20%	8 hours	Presentation, Video presentation,Chalk board,Notes

Unit 2:Theory: The concept of industrial safety, health and environment - need, nature and importance. Focus on Human resource, and concept of importance of 'man' as central theme in safety. Concept of accident prevention, occupantional health and environmental protection. Problems of Industrial safety, occupational health and environmental pollution & modern concept of SHE	20%	5 hours	Presentation, Video presentation,Chalk board,Notes
Unit 3: History and role of building codes and safety legislation, concept of safety versus risk, enforcement of codes and standards, role of government agencies and emergency services in enforcing legislation, government framework and infrastructure involved in safety legislation enforcement. Role of code enforcement, plan review and approval, record keeping, public education	20%	4 hours	Presentation, Video presentation
Unit 4: Industrial Fire & Safety management concepts – hazard identification and risk assessment, risk reduction and control methods. Design aspects such as segregation and separation, fire resisting construction, emergency exit arrangements, access for emergency agencies, fire protection systems, safe operational practices, maintenance and upkeep of systems, planning for emergency response. Design approaches for fire and safety, NFPA fire safety concepts tree.	20%	5 hours	Presentation, Video presentation
Unit 5: Environmental Pollution Air Pollution Sources and effects of air pollution, NAAQS Basic principles of air pollution control devices Global effects of air pollution, Air Pollution due to automobiles, photochemical smog. Water Pollution: Sources and effects, Effluent standards Domestic and Industrial wastewater and treatment principles, Land pollution:- Solid waste, solid waste management by land filling, composting. Social Issues and the environment, from unsustainable to sustainable development, urban problems related to energy, water conservation, rain water harvesting, watershed management, resettlement and rehabilitation of people; its problems and concerns.	20%	8 hours	Presentation, Video presentation

LEARNING RESOURCES

TEXTBOOKS	1. Cote, Arthur, Section 1, Fire protection Handbook, 20th Edition, NFPA 2. Handbook of Industrial Safety by K.U. Mistry, SiddarthPrakashan, Gujarat

	3. Industrial Accident Prevention by H.W. Heinrich, McGraw Hill Book Co. 4. Techniques of Safety Management by Dan Pederson. 5. Purandare D.D. Handbook on Industrial Fire Safety, P&A Publications 6. Fawcett H.H. and W.S. WOOD, Safety and Accident Prevention in chemical operations, 2nd Edition John Wiley and Sons Inc (1982)
REFERENCE BOOKS	1. Cheunisinoff&Graffia, Environmental Health & Safety Management,. Reprint Jaico Publishing House. 2. Tarafdar, Industrial Safety Management
Journals & Periodicals:	**NIL**
Other Electronic Resources:	**NIL**

Evaluation Scheme	**Total Marks 100 marks**	
Mid semester Marks	30 marks	
End Semester Marks	50 marks	
Continuous Evaluation Marks (20 Marks)	**CATEGORY**	**MARKS**
	Attendance	5 MARKS
	Quiz	5 MARKS
	Skill enhancement activities / case study	5 MARKS
	Presentation/ miscellaneous activities	5 MARKS
	1. Students will understand the fire and EHS challenges faced in the built and industrial environment, and the current approaches taken to address the same.	

Course Outcomes	2. Students will learn about major incidents which affected industrial and societal attitude towards safety.
	3. Students will become familiar with the history and development of fire & safety legislation, their current form and role of different agencies involved in their implementation.
	4. Students will be able to explain the different design approaches for addressing the fire & life safety challenges in built and industrial environments
	5. Students will become aware of the different engineering and management concepts applied for addressing fire and safety risks in industrial scenarios.

Second Semester

SEMESTER 2 – COMMON FOR ALL BRANCHES													
Sr No	Course Code	Course Name	TEACHING SCHEME					EXAM SCHEME					
								THEORY MARKS			PRACTICAL		
			L	T	P	C	Hrs/ week	CE	MID SEM	END SEM	LAB WORK	LAB EXAM	TOTAL
1	BTEC201	Engineering Fundamentals	3	0	0	3	3	20	50	30	--	--	100
2	BTME202	Engineering Graphics	3	0	2	4	5	20	50	30	25	25	150
3	BTMA203	Mathematics - II	3	1	0	4	4	20	50	30	--	--	100
4	BTME204	Engineering Mechanics	4	0	2	5	6	20	50	30	25	25	150
5	BTCY205	Engineering Chemistry	3	0	2	4	5	20	50	30	25	25	150
6	BTEC206	Computer Programming-II	0	0	2	1	2	--	--	--	25	25	50
7	BTME207	AutoCAD	0	0	2	1	2	--	--	--	25	25	50
		Total	**16**	**1**	**10**	**22**	**27**						**750**

MS - Mid Semester, ES - End Semester, CE - Continuous Evaluation, LW - Laboratory Work, LE - Laboratory Exam

BTEC201	Engineering Fundamentals	L	T	P	C
		3	0	0	3

Total Credits:3	Total Hours in semester :45	Total Marks:100

1	**Course Pre-requisites:Nil**
2	**Course Category: Core Courses**
3	**Course Revision/ Approval Date:23rd June 2020**

4. **Course Objectives :**

1	To provide Basic knowledge of Engineering Materials,
2	To provide Basic knowledge of Thermodynamics, heat engines
3	To provide Basic knowledge of Engineering equipment
4	To provide Basic knowledge of Measurement
5	To provide Basic knowledge of Production

Course Content	Weightage	Contact hours	Pedagogy

Unit 1: Theory: ClassificationClassification of engineering material, Composition of Cast iron and Carbon steels, Iron Carbon diagram. Alloy steels their applications. Mechanical properties like strength, hardness, toughness , ductility, brittleness , malleability etc. of materials, Tensile test- Stress-strain diagram of ductile and brittle materials Hooks law and modulus of elasticity, Hardness and Impact testing of materials, BHN etc.	20%	9 hours	Presentation, Video presentation,Chalk board,Notes
Unit 2: Theory: ConceptConcept of measurements, errors in measurement, Temperature, Pressure, Velocity, Flow strain, Force and torque measurement,Vernier caliper, Micrometer, Dial gauge, Slip gauge, Sine-bar and Combination set	20%	9 hours	Presentation, Video presentation,Chalk board,Notes
Unit 3: Theory: Elementary theoretical aspects of production processes like casting, welding etc Introduction to Lathe and Drilling machines and their various operations.	20%	9 hours	Presentation, Video presentation,Chalk board,Notes
Unit 4: Theory: Fluid Fluid properties pressure, density and viscosity etc. Types of fluids, Newton's law of viscosity, Pascal's law, Bernoulli's equation for incompressible fluids, Types and working principle of Hydraulic machines, pumps, turbines, Reciprocating pumps and valves.	20%	10 hours	Presentation, Video presentation,Chalk board,Notes
Unit 5: Thermodynamic system, properties, state, process, Zeroth, First and second law of thermodynamics, thermodynamic processes at constant pressure, volume, enthalpy & entropy.Classification and working of boilers, mountings and accessories of boilers, Efficiency and performance analysis, Types and working principle of Heat Exchangers, Condenser, Distillation column.	20%	9 hours	Presentation, Video presentation,Chalk board,Notes

LEARNING RESOURCES	
TEXTBOOKS	1. RK Bansal Fluid Mechanics & Machinery, Laxmi Publication. 2. Basant Agrawal, Agrawal C M, Basic Mechanical Engineering ,Wiley Publication. 3. O. P. Khanna's material science & metallurgy, Dhanpat Rai Publication.
REFERENCE BOOKS	1. Nakra& Chaudhary, Instrumentation and Measurements, TMH. 2. Nag P.K, Engineering Thermodynamics, TMH .
Journals & Periodicals:	**NIL**
Other Electronic Resources:	**NIL**

Evaluation Scheme	**Total Marks 100 marks**	
Mid semester Marks	30 marks	
End Semester Marks	50 marks	
Continuous Evaluation Marks (20 Marks)	**CATEGORY**	**MARKS**
	Attendance	5 MARKS
	Quiz	5 MARKS
	Skill enhancement activities / case study	5 MARKS
	Presentation/ miscellaneous activities	5 MARKS

Course Outcomes	
	● Students would be able to understand the need of engineering materials, and its property, need and defects.
	• Students would be able to analyses basics of thermodynamics and able to understand various process
	● Students would be able to understand I C engines, their working and operating conditions.
	● Students will be able to understand the basics of Fluid mechanics, Law and properties of fluid.
	● Students would be able to recognize production methodology and their need.

BTME202	Engineering Graphics	L	T	P	C
		3	0	2	4
Total Credits:4	**Total Hours in semester :45hrs +30 hrs**		**Total Marks:100**		

1	**Course Pre-requisites: Zeal to learn the subject**
2	**Course Category: Core Courses**
3	**Course Revision/ Approval Date:23rd June 2020**

4. **Course Objectives :**

1	Illustrate the projections of points and lines, planes, solids and section of solids.
2	Recognize the dimensions, units, and annotate 2D & 3D engineering drawings.
3	Identify the application of Loci of points and engineering curves in the field of engineering.
4	Identify the need of development of lateral surfaces and apply the same in engineering drawing.
5	Sketch orthographic projections into isometric projections and vice versa for complicated geometries.

Course Content	Weightage	Contact hours	Pedagogy

Unit 1: Introduction to Engineering Graphics & Engineering Curves: **Theory:**Introduction, Drawing Instruments and Their Uses, BIS - SP46, Sheet Layout, Types Of Lines And Its Applications, Lettering, Dimensioning Methods, Scales, And Geometric Construction.Introduction, Classification of Engineering Curves, Conic Curves (Ellipse, Parabola, And Hyperbola), Cycloid, Involute, And Spiral. **Practical:** 1. Introduction of dimensioning methods, various scales, different types of line, construction of different polygon, etc. 2. Solve problems on dimensioning methods,various scales, etc. and draw them on A2 size drawing sheet 3. Solve problems on conic section and draw them on A2 size drawing sheet **4.** Solve problems on engineering curves and draw them on A2 size drawing sheet	25%	20 hours	Presentation, Video presentation
Unit 2: Projection of Points and Lines: **Theory:** Introduction to Point and Lines Tracing of Lines, Projections Of The Points Located In Same Quadrant And Different Quadrants, Types Of Plane, Projections Of Line With Its Inclination To One Reference Plane And With Two Reference Planes, True Length Of The Line And Its Inclination With The Reference Planes. **Practical:** 1. **Solve** problems on Projection of line and draw them on A2 size drawing sheet	15%	12hours	Presentation, Video presentation
Unit 3: Projections of Planes, Solids, & Section of Solids. **Theory:** Introduction, Projections of planes (polygons, circle and ellipse) with its inclination to one reference plane and with two reference planes, Concept of auxiliary plane method for projections of the plane Introduction, Classification of Solids, Projections of Solids Like Cylinder, Cone, Pyramid and Prism With Its Inclination To One Reference Plane And With Two	25%	22 hours	Presentation, Video presentation

Reference Planes. Section of Solids: Introduction, Section of Prism, Pyramid, Cylinder, And Cone, The True Shape Of The Section. **Practical:** 1. Solve problems on Projection of plane and draw them on A2 size drawing sheet **2.** Solve problems on Projection of solid and draw them on A2 size drawing sheet			
Unit 4: Development of Lateral Surfaces: **Theory:** Introduction, Concept of Development of The Different Surfaces, Parallel Line Development and Radial Line Development. **Practical:** 1. Solve problems on Development of surface and draw them on A2 size drawing sheet	10%	10 hours	Presentation, Video presentation
Unit 5: Orthographic Projection & Isometric Projection: **Theory:** Introduction, Principle of Projection, Method of Projection, Planes Of Projection. First and Third Angle Projection Methods, Sectional Views, Orthographic Reading.Introduction, Isometric Axis, Isometric Scale, Isometric Drawing and Isometric View. Conversion of Orthographic Views to Isometric Projection/Drawing. **Practical:** **1.** Solve problems on Orthographic projection and draw them on A2 size drawing sheet **2.** Solve problems on Isometric projection and draw them on A2 size drawing sheet	25%	22 hours	Presentation, Video presentation

LEARNING RESOURCES

TEXTBOOKS	1. P.J. Shah, "A Textbook of Engineering Graphics", S. Chand& Company Ltd. 2. N. D. Bhatt, "Engineering drawing", Charottar publication.
REFERENCE	1. T. Jeyapoovan, "Engineering Drawing & Graphics using Auto CAD 2000", Vikas Publishing House Pvt. Ltd., New Delhi

BOOKS	2. P.S. Gill, "A textbook of Engineering Drawing", S.K. Kataria& sons, Delhi. 3. D.A. Jolhe, "Engineering Drawing with an Introduction to Auto CAD", Tata McGraw- Hill Publishing Co. Ltd., New Delhi. 4. R.K. Dhawan, "A textbook of Engineering Drawing", S. Chand& Company Ltd., New Delhi. 5. Shah, M.B., Rana, B.C., Engineering Drawing, 2ndEdition, Pearson Education, (2009). 6. French, T.E., Vierck, C.J., Foster, R.J., Graphic Science and Design, 4thEdition, McGraw Hill, (1984). 7. Venugopal, K., Engineering Drawing and Graphics, 3rdEdition, New Age International, (1998). 8. Arunoday Kumar, "Engineering Graphics", Tech – Max Publication, Pune.
Journals & Periodicals:	1. Mechanics Based Design of Structures and Machines **2.** Materials & Design **3.** Engineering Structures
Other Electronic Resources:	1. https://nptel.ac.in/courses/112103019/ **2.** https://www.udemy.com/course/ed/

Evaluation Scheme	**Total Marks 100 marks**	
Mid semester Marks	30 marks	
End Semester Marks	50 marks	
Continuous Evaluation Marks (20 Marks)	**CATEGORY**	**MARKS**
	Attendance	5 MARKS
	Quiz	5 MARKS
	Skill enhancement activities / case study	5 MARKS
	Presentation/ miscellaneous activities	5 MARKS
	• Understand the standards and common cases as well as dimensioning in technical drawings development..	
	• Able to develop multi-aspect sketches, sectional views and geometries of the development of design projects.	

Course Outcomes	• Visualize objects in all dimensions and learn displaying techniques for graphical communication in design process.

		L	T	P	C
BTMA203	**Mathematics - II**	**3**	**1**	**0**	**4**

Total Credits:4	**Total Hours in semester :45hrs + 15 hrs**	**Total Marks:100**

1	**Course Pre-requisites:** Mathematics-I, Matrices
2	**Course Category: Core Courses**
3	**Course Revision/ Approval Date:23rd June 2020**

4. **Course Objectives :**

1	To understand part of basic pure mathematics running with some simple experiments.
2	To learn computations with linear algebra and ordinary differential equations.
3	To identify some standard differential equations and technique to solve it.
4	Understand application of linear algebra like system of linear equations, diagonalization
5	To understand Laplace transform

Course Content	**Weightage**	**Contact hours**	**Pedagogy**

Unit 1:Theory: First ordered odes: Exact equations, Integrating factors, Linear and Bernoulli's equation, Homogeneous equation, Applications of first order equations: Orthogonal trajectories, Mixture problem, and Temperature problem.	20%	8 hours	Chalk board,Notes
Unit 2:Theory: Higher ordered LinearODEs with constant coefficients, Wronskians, Differential operators, Method of solving homogeneous equations, Non- homogeneous equations, Inverse operators, Methods of solving non-homogeneous equations. Cauchy- Euler equations, Method of undetermined coefficients, Method of variation of parameters**.**	20%	10 hours	Chalk board,Notes
Unit 3:Theory: Laplace and Inverse Laplace transforms, Shifting theorems, Convolution theorem, Laplace transform of Derivative and Integration, Solution of linear ODE's using Laplace transform. Initial and boundary value problems, Applications of Laplace transforms: Solution of Heat, Wave and Laplace's equations.	20%	10 hours	Chalk board,Notes
Unit 4:Theory: Double and Triple integration, Change of order of double integration, double integration in Polar form, Jacobians and change of variables formula. Applications to find area and volume.	20%	10 hours	Chalk board,Notes
Unit 5:Theory: Vector valued functions, gradient and directional derivatives, Divergence and curl, Vector identities. Line Integral and Green's Theorem.	20%	7 hours	Chalk board,Notes

LEARNING RESOURCES

TEXTBOOKS	1. Veerarajan T., Engineering Mathematics for first year, Tata McGraw-Hill,New Delhi, 2008.
REFERENCE BOOKS	Kreyszig, E., Advanced Engineering Mathematics, 8th Edition, Wiley & Sons,(1999). Anton, H., Elementary Linear Algebra with Applications, 8th Edition, John Wiley & Sons, (1995)

Journals & Periodicals:	**NIL**
Other Electronic Resources:	**NIL**

Evaluation Scheme	**Total Marks 100 marks**
Mid semester Marks	30 marks
End Semester Marks	50 marks

Continuous Evaluation Marks (20 Marks)	**CATEGORY**	**MARKS**
	Attendance	5 MARKS
	Quiz	5 MARKS
	Skill enhancement activities / case study	5 MARKS
	Presentation/ miscellaneous activities	5 MARKS

Course Outcomes	
	Identify and solve some ordinary differential equations.
	Based on some experiments, form ordinary differential equations.
	Apply basic knowledge of mathematics to solve real world problems.
	Analyze and solve engineering problems using Laplace Series.
	Select and combine the necessary Laplace transform techniques to solve second-order ordinary differential equations involving the Dirac delta (or unit impulse).

BTME204	**Engineering Mechanics**	**L**	**T**	**P**	**C**
		4	**0**	**2**	**5**

Total Credits:5		**Total Hours in semester :60hrs +30hrs**		**Total Marks:100**	
1	**Course Pre-requisites:** Basic knowledge of Physics and Mathematics				
2	**Course Category: Core Courses**				
3	**Course Revision/ Approval Date:23rd June 2020**				
4. **Course Objectives :**					
1	Application of systematic engineering synthesis and design processes.				
2	Comprehensive, theory based understanding of the underpinning natural and physical sciences and the engineering fundamentals applicable to the engineering discipline.				
3	In-depth understanding of specialist bodies of knowledge within the engineering discipline.				
4	Application of established engineering methods to complex engineering problem solving.				

Course Content	**Weightage**	**Contact hours**	**Pedagogy**
Unit 1:Rigid Body Statics **Theory:** Vector algebra, force systems, moment of a force about a point and about an axis; simplest equivalent forces and moment; free body diagram; force equilibrium, equations of equilibrium; problems in two and three dimensions. Types of loading, supports and reactions; evaluating internal forces in bodies; axial force, Basic of shear force and bending moment. Planar Trusses and frames: static indeterminacy, analysis by method of joints and method of sections.	30%	25 hours	Presentation, Video presentation Chalk board Notes

Practical: 1. Justify law of parallelogram of forces for a coplanar concurrent force system in equilibrium. 2. Justify law of polygon of forces for a coplanar concurrent force system in equilibrium. 3. Calculate the magnitude and nature of forces in members of the jib-crane. 4. Verify lemi's theorem. **5.** Verify the principle of moment using bell crank lever. **6.** Verify the support reactions and verify the condition of equilibrium for a simply supported beam at ends.			
Unit 2:Center of Gravity 1. **Theory:** Centroid of lines, plane areas and volumes,Examples related to centroid of composite geometry	15%	12 hours	Presentation, Video,presentation,Chalk board,Notes
Unit 3:Moment of Inertia Theory: First and second moment of area and mass, radius of gyration, parallel axis theorem, product of inertia, rotation of axes and principal M.I., Thin plates, M.I. by direct method (integration), composite bodies. **Practical:** **1.** Calculate Mass moment of inertia of a fly wheel.	15%	12 hours	Presentation, Video presentation Chalk board Notes

Unit 4: Friction Theory: Types and laws of friction, impending motion problems involving large and small contact surfaces: wedge friction, ladder friction. **Practical:** 1. Determine the co-efficient of static friction between 1. glass and wood; 2. wood and cloth; and 3. wood and metal. (Horizontal surface) 2. Determine the co-efficient of static friction between 1. glass and wood; 2. wood and cloth; and 3. wood and metal. (Inclined surface)	20%	18 hours	Presentation, Video presentation Chalk board Notes
Unit 5:Dynamics Theory: Kinematics and Kinetics of particles: Particle dynamics in rectangular coordinates cylindrical coordinates and in terms of path variables. Dynamics of rigid bodies: Newton's laws, Chasle's Theorem; D' Alembert's Principal, Work & Energy and Impulse Momentum methods, Impact.	20%	18 hours	Presentation, Video presentation Chalk board Notes

LEARNING RESOURCES

TEXTBOOKS	1. Shames, I.H., Rao, G.K.M., Engineering Mechanics – Statics and Dynamics, Pearson's Education, (2006). 2. Desai and Mistry, "Engineering Mechanics", Popular Prakashan.
REFERENCE BOOKS	1. Beer, F.P., Johnston, E.R., Vector Mechanics for Engineers, Vol. 1 - Statics, Vol. 2, Dynamics, 9thEdition, Tata McGraw Hill, (2011). 2. Meriam, J.L., Kraige, L.G., Engineering Mechanics, Vol. I Statics, Vol. 2 Dynamics, 6thEdition, John Wiley, (2008). 3. Timoshenko, S., Young, D.H., Engineering Mechanics, McGraw Hill Inc., (1940).
Journals & Periodicals:	1. Mechanics Based Design of Structures and Machines 2. Materials & Design 3. Engineering Structures

	4. Journal of Computational Design and Engineering **5.** Engineering with Computers
Other Electronic Resources:	1.https://nptel.ac.in/courses/112103109/ **2.**https://swayam.gov.in/courses/5241-engineering-mechanics **3.**https://www.edx.org/course/engineering-mechanics-2

Evaluation Scheme	**Total Marks 100 marks**	
Mid semester Marks	30 marks	
End Semester Marks	50 marks	
Continuous Evaluation Marks (20 Marks)	**CATEGORY**	**MARKS**
	Attendance	5 MARKS
	Quiz	5 MARKS
	Skill enhancement activities / case study	5 MARKS
	Presentation/ miscellaneous activities	5 MARKS
Course Outcomes	• Use scalar and vector analytical techniques for analyzing for statically determinate/indeterminate structures.	
	• Apply fundamental concepts of kinematics and kinetics of particles to the analysis of simple, practical problems.	
	• Apply basic knowledge of mathematics and physics to solve real-world problems.	

BTCY205	**Engineering Chemistry**	**L**	**T**	**P**	**C**
		3	**0**	**2**	**4**
Total Credits:4	**Total Hours in semester :45hrs + 30 hrs**		**Total Marks:100**		

1	**Course Pre-requisites:** Students having background of chemistry at higher secondary level
2	**Course Category: Core Courses**
3	**Course Revision/ Approval Date:23rd June 2020**

4. **Course Objectives :**

1	To impart sound knowledge in the different fields of theoretical chemistry so as to apply it to the problems in the engineering field.
2	To understand hardness of water, its analysis and treatment along with its calculation
3	To study corrosion, various types and its prevention techniques
4	To study about fuels, its analysis, combustion and calculation
5	To understand lubrication and its property determination, also to learn various instrumental techniques in Chemical analysis

Course Content	**Weightage**	**Contact hours**	**Pedagogy**

Unit 1: Water Technology **Theory:** Chemistry of water, Types of impurities in water, Types of hardness, Units of hardness, Estimation of hardness-EDTA method, Disadvantages of using hard water for industrial purpose. Scale and sludge formation in boiler, Caustic embrittlement-Priming and foaming. Softening of water: Ion exchange process, Lime soda process (with numerical's), Zeolite process- Desalination. Reverse osmosis. Drinking water and its characteristics. Numericals to calculate hardness of water **Practical:** **1.** To estimate the amount of total hardness present in the given sample of water by EDTA method. 2. To Measure the pH value Of Given Solutions. 3. To determine alkalinity of given water sample. **4.** To determine the acidity of the given water sample.	20%	12 hours	Activities,Chalk board,Notes
Unit 2: Corrosion, Control and Prevention **Theory:** Introduction, Corrosion problems, Types of corrosion: Chemical corrosion-Pilling Bedworth Rule and Electrochemical corrosion. Theory of corrosion, pitting corrosion, crevice corrosion, waterline corrosion. Factors affecting corrosion, Corrosion control methods, Corrosion inhibitors. **Protective Coatings:**Metallic coatings – Galvanizing, Tinning and electroplating – Non-metallic coatings –Chromate coating and Anodising. Powder coating – methods of application and advantages. **Practical:** 1. To measure a rate of corrosion of Iron in different medium.	20%	13hours	ppt, chalk-board,activities

Unit 3: Fuels & Combustion **Theory:** Fossil fuels & classification, Calorific value & its types, Determination of calorific value by Bomb calorimeter, Proximate and Ultimate analysis of coal and their significance, calculation of calorific value by Dulong's formula, Knocking, relationship between' knocking & structure of hydrocarbon, Octane number, Cetane number, combustion and it related numerical problems.	20%	10	ppt, chalk-board,activities
Unit 4:Lubricants **Theory:** Introduction, Mechanism of lubrication, Classification of lubricants, significance & determination of Viscosity ,Viscosity Index, Flash & Fire Points, Cloud & Pour Points, Carbon Residue, Aniline Point, Acid Number, Saponification Number. **Practical:** 1. To measure viscosity of a given sample. **2.** To determine flash point and fire point of a given sample. **3.** To determine cloud point and pour point of a given sample.	20%	5 + 8	ppt, chalk-board,activities
Unit 5: Instrumental Techniques In Chemical Analysis **Theory:** Lambert's and Beer's Law and its applications, Introduction, Principle, Instrumentation and applications of IR & UV spectroscopy, Gas Chromatography & its applications.	20 %	5	ppt, chalk-board,activities

LEARNING RESOURCES

TEXTBOOKS	1. Engineering Chemistry, P.C. Jain, DhanpatRai Pub. Co. 2. Engineering Chemistry, S. S. Dara, S. Chand Pub. New Delhi
REFERENCE BOOKS	1. Wiley's Engineering Chemistry, Multiple Authors, Wiley International 2. Engineering Chemistry, R. Gopalan

	3. L. H. Van Vleck; Elements of Material Science and Engineering, Addison-Wesley Publishing Co.
Journals & Periodicals:	Journal of Chemical Technology, Environmental Science and Technology, Chemical Engineering Science, Energy and Fuels
Other Electronic Resources:	NPTEL

Evaluation Scheme	**Total Marks 100 marks**
Mid semester Marks	30 marks
End Semester Marks	50 marks

Continuous Evaluation Marks (20 Marks)	**CATEGORY**	**MARKS**
	Attendance	5 MARKS
	Quiz	5 MARKS
	Skill enhancement activities / case study	5 MARKS
	Presentation/ miscellaneous activities	5 MARKS

Course Outcomes	
	1. The confidence level of students will be improved.
	2. The students understand Engineering materials with properties that find various engineering applications.
	3. Use the analysis results to ascertain quality of water, and other material.
	4. Students would be able to solve the problems in the engineering field related to chemical aspects.
	5. Students will have knowledge of all equipments pertaining to mentioned topics.

BTCS206	COMPUTER PROGRAMMING-II	L	T	P	C
		0	0	2	1
Total Credits:1	**Total Hours in semester :30**		**Total Marks:50**		

1	**Course Pre-requisites:** NIL
2	**Course Category: Core Courses**
3	**Course Revision/ Approval Date:23rd June 2020**

4. **Course Objectives :**

1	Identify/characterize/define a problem.
2	Design a program to solve the problem.
3	Create executable code.
4	Read most Python code.
5	Write basic unit tests.

Course Content	Weightage	Contact hours	Pedagogy
Unit 1:Practical: 1. Compute the GCD of two numbers. **2.** Find the square root of a number (Newton's method) **3.** Exponentiation (power of a number)	20%	6 hours	PPT,Computer practicals, video clips

Unit 2:Practical: 4. Find the maximum of a list of numbers 5. Linear search and Binary search 6. Selection sort, Insertion sort	20%	6 hours	PPT,Computer practicals
Unit 3:Practical: 7. Merge sorting of numbers **8.** Find First n prime numbers **9.** Create Multiply matrices	20%	6 hours	PPT,Computer practicals
Unit 4:Practical: 10. Programs that take command line arguments (word count) **11.** Find the most frequent words in a text read from a file **12.** . Simulate elliptical orbits in Pygame	20%	5hours	PPT,Computer practicals
Unit 5:Practical: **13.** Simulate bouncing ball using Pygame **14.** Student group mini project	20%	6 hours	PPT,Computer practicals

LEARNING RESOURCES

TEXTBOOKS	Head-First Python (2nd edition), Paul Barru, OREILLY Publication
REFERENCE BOOKS	NIL
Journals & Periodicals:	**NIL**
Other Electronic	The Python Tutorial — Python 3.8.2 documentationdocs.python.org › tutorial

Resources:	

Evaluation Scheme	**Total Marks 100 marks**	
Mid semester Marks	-	
End Semester Marks	50 marks	
Continuous Evaluation Marks (20 Marks)	**CATEGORY**	**MARKS**
	Attendance	5 MARKS
	Quiz	
	Skill enhancement activities / case study	45 MARKS
	Presentation/ miscellaneous activities	
Course Outcomes	1. Identify/characterize/define a problem. 2. Design a program to solve the problem. 3. Create executable code. 4. Read most Python code. 5. Write basic unit tests.	

BTME207	**AutoCad**	**L**	**T**	**P**	**C**
		0	**0**	**2**	**1**

Total Credits:1	**Total Hours in semester :30**	**Total Marks:100**

1	**Course Pre-requisites: nil**
2	**Course Category: Core Courses**

3	**Course Revision/ Approval Date:**

4. **Course Objectives :**	
1	Recognize the basic commands of AutoCAD software.
2	Understand the concept of Computer Aided Drafting using AutoCAD software.
3	Apply basic concepts to develop construction (drawing) techniques
4	Demonstrate basic concepts of the AutoCAD software
5	Understand and demonstrate dimensioning concepts and techniques

Course Content	**Weightage**	**Contact hours**	**Pedagogy**
Unit 1: Introduction to Auto CAD: **Theory:** Starting with AutoCAD, AutoCAD dialog boxes, Co-ordinate Systems, drawing lines, circle, arcs, rectangle, ellipse, polygons, etc. [Exercises] **Practical:**Introduction to Auto CAD**.**	20%	6 hours	PPT/activity
Unit 2:Editing sketched objects **Theory:** Editing sketches, moving, copying, pasting, offsetting, scaling, chamfering, trimming, mirroring. Filleting, sketched objects. [Exercises] **Practical:**Perform various editing operations in AutoCAD.	20%	6 hours	PPT/activity
Unit 3:Basic dimensioning: **Theory:** Geometric dimensioning and Tolerance: Dimensioning AutoCAD, Creating linear, rotated, angular aligned base line Dimensions, Modifying	20%	6 hours	PPT/activity

dimensions. **Practical:**Apply various dimensioning methods to a machine component in AutoCAD.			
Unit 4: Plotting:**Theory:** Plotting the drawings in AutoCAD, plotting drawing using the plot dialog box, adding plotters and using plot styles, plotting sheets. **Practical:**Perform various plotting operations in AutoCAD.	20%	6 hours	PPT/activity
Unit 5:Basics of 3D Modelling: **Theory:** Generation of Primitive Solids, Boolean Operations, Region, Boundary Layer operations, Extrude, Subtract, Union, Explode, Exercises, Exercises **Practical:**Perform 3D Modelling in AutoCAD.	20%	6 hours	PPT/activity

LEARNING RESOURCES

TEXTBOOKS	1. Sham Tickooet. al., "AutoCAD 2012 for engineering and designers" Dream tech press, New Delhi
REFERENCE BOOKS	1. Finkelstein Ellen et. al., "AutoCAD 2012 and AutoCAD LT 2012 Bible" Wiley India, New Delhi
Journals & Periodicals:	1. Mechanics Based Design of Structures and Machines 2. Engineering Structures 3. Journal of Computational Design and Engineering 4. Engineering with Computers
Other Electronic Resources:	1.https://www.udemy.com/topic/autocad/ 2.https://www.autodesk.com/training 3.https://www.coursera.org/autodesk

Evaluation Scheme	**Total Marks 100 marks**	
Mid semester Marks	30 marks	
End Semester Marks	50 marks	
Continuous Evaluation Marks (20 Marks)	**CATEGORY**	**MARKS**
	Attendance	5 MARKS
	Quiz	5 MARKS
	Skill enhancement activities / case study	5 MARKS
	Presentation/ miscellaneous activities	5 MARKS
Course Outcomes	Understand the standards and common cases as well as dimensioning in technical drawings development.	
	Ability to manipulate drawings through editing and plotting techniques	
	Visualize objects in all dimensions and learn displaying techniques for graphical communication in design process.	
	Become familiar with Solid Modeling concepts and techniques.	
	Become familiar with the use of Blocks, Design Center, and Tool Palettes	

Third Semester

SEMESTER 3													
Sr No	Course Code	Course Name	TEACHING SCHEME					EXAM SCHEME					TOTAL
								THEORY MARKS			PRACTICAL		
			L	T	P	C	Hrs/week	CE	MID SEM	END SEM	LAB WORK	LAB EXAM	
1	20C301	Mathematics - III	3	1	0	4	4	20	30	50	-	-	100
2	20BTFS301	Safety Management-I	3	0	0	3	3	20	30	50	-	-	100
3	20BTFS302	Legislations related to Fire & EHS	3	0	0	3	3	20	30	50	-	-	100
4	20BTFS303	Town Planning and Building Design	3	0	2	4	5	20	30	50	20	30	150
5	20BTFS304	Strength of Materials	3	0	2	4	5	20	30	50	-	-	150
6	20BTFS305	Automobile Engineering & Safety	3	0	0	3	3	20	30	50	-	-	100
TOTAL						**21**	**23**	**TOTAL MARKS**					**700**

MS - Mid Semester, ES - End Semester, CE - Continuous Evaluation, LW - Laboratory Work, LE - Laboratory Exam

19C301	Mathematics - III	L	T	P	C
		3	1	0	4
Total Credits: 4	**Total Hours in semester :60**		**Total Marks:100**		

1	**Course Pre-requisites:** Mathematics - II
2	**Course Category: Core Courses**
3	**Course Revision/ Approval Date: 23rd June 2020**

4. **Course Objectives :**

1	To understand behavior of complex functions as compared to real functions.
2	To introduce special differential equations and to learn series solution methods to solve them.
3	To study periodic functions and their representations as series
4	To introduce students to partial differential equations
5	To study some important partial differential equations and their solutions

Course Content	Weightage	Contact hours	Pedagogy
Unit 1:Theory: **Complex Analysis:** Complex number, polar form and triangle inequality. Function of a complex variable, Elementary functions, Definition and properties of analytics functions; Cauchy-Riemann equations, Cauchy's integral theorem and its applications. Review of Power series; Taylor series and Laurent expansions; Regular and irregular singular points, Residues and the Cauchy residue formula**;** Evaluation of improper integrals.	20%	10 hours	Chalk board Notes

Unit 2:Theory: **Partial Differential Equations -** First order partial differential equations, Formation of partial differential equations from given solutions, four standard forms of non-linear first order equations. Application of first order partial differential equations: One dimensional Heat and Wave equation, Two-dimensional Heat equation.	20%	18 hours	Chalk board Notes
Unit 3:. **Fourier series -**Half-ranged cosine and sine series.	20%	14 hours	Chalk board ,Notes
Unit 4: Probability - Definitions of probability, sampling theorems, conditional probability	20%	10 hours	Chalk board,Notes
Unit 5: Statistics - mean, median, mode and standard deviation; random variables, binomial, Poisson and normal distributions.	20%	8 hours	Presentation, Chalk board Notes

LEARNING RESOURCES

TEXTBOOKS	1. Churchill, R.V., and Brown, J.W., Complex variables and applications, 7th edition, McGraw Hill, (2003) 2. Boyce, W.E., and DiPrima, R., Elementary Differential Equations, 8th Edition, John Wiley & Sons, (2005). 3. Churchill, R.V., and Brown, J.W., Fourier series and boundary value Problems, 7th Edition, McGraw-Hill, (2006). 4. S.C. Gupta & V. K. Kapoor, Fundamentals of Mathematical statistics, 10th Edition, S. Chand & Sons. 5. Spiegel. M.R., Schiller. J., and Srinivasan. R.A., "Schaum's Outlines on Probability and Statistics", Tata McGraw Hill Edition, 2004.
REFERENCE BOOKS	• Kreyszig, E., Advanced Engineering Mathematics, 8thEdition,JohnWiley& Sons, (1999).

Journals & Periodicals:	**NIL**
Other Electronic Resources:	**NIL**

Evaluation Scheme		**Total Marks 100 marks**
Mid semester Marks	30 marks	
End Semester Marks	50 marks	
Continuous Evaluation Marks (20 Marks)	**CATEGORY**	**MARKS**
	Attendance	5 MARKS
	Quiz	5 MARKS
	Skill enhancement activities / case study	5 MARKS
	Presentation/ miscellaneous activities	5 MARKS

Course Outcomes	1. Work with complex valued functions.
	2. Compute some real improper integrals using techniques of complex functions
	3. Solve linear ordinary differential equations by using series expansion around regular and singular points.
	4. Expand one variable functions in series for example in Fourier series, Bessel series, Legendre series.
	5. Solve some most important partial differential equations occurring in engineering applications by the method of Separation of variables and the use of Fourier series.

BTFS301	Safety Management-I	L	T	P	C
		3	0	0	3
Total Credits: 3	**Total Hours in semester :45**	**Total Marks:100**			

1	**Course Pre-requisites:** Fundamentals of Fire &Safety ,Health Environment
2	**Course Category: Core Courses**
3	**Course Revision/ Approval Date:23rd June 2020**

4. **Course Objectives :**

1	To learn the basic concept of safety and its development process up to the modern concept of SHE i.e. Safety, Health and Environment.
2	To understand this concept of safety, problems of industrial accidents, safety technology, safety philosophy, safety psychology, principles of general management and their applicability to the safety management.
3	To understand the managerial functions of safety planning, organizing, directing and controlling for industrial safety activities.
4	To learn safety management techniques of education and training, motivation and participation of employees in safety, costs calculation of accidents .
5	To learn relevance to safety budget and finally the MIS for safety.

Course Content	Weightage	Contact hours	Pedagogy
Unit 1:Theory: INTRODUCTION: The Concept of Safety -.Need, Nature & Importance -.Focus on "Human Resource".Safety of "Man" at the center -The concept development as Accident prevention, Occupational health and Environmental protection-.The modern concept of SHE or HSEProblems of Industrial Safety&Accident -.Occupational Health and Environmental Pollution-Factors impeding safety -. Reasons of accident prevention	20%	10 hours	Presentation, Video presentation Chalk board Notes

Importance of Safety Technology and Engineering for minimizing the accidents. PHILOSOPHY OF SAFETY: -Meaning of Philosophy and Safety Philosophy. Its scope.- Explanation of basic Definitions and Safety Terminology ,Incident, accident, major accident hazard (MAH), oversight, error, mistake,near miss, injury, unsafe act, unsafe condition, hazard, risk etc-Accident Causation Theories - H W Heinrich's Ten Axioms of industrial safety.-. Heinrich's Domino Theory and his "ratio".-Accident Prevention. -Five Fundamentals of Accident Prevention – Organization, Fact Finding, Analyses of the facts, Selection of Remedy and Application ofRemedy.-Five "E"s of Accident Prevention – Engineering control, Education and training, Enforcement, Enthusiasm and Example setting. SAFETY PSYCHOLOGY: - Meaning of psychology, safety psychology and its importance.- Psychological factors affecting work and accidents.- Attitudes, Aptitudes, Frustration, Conflict, Morale, Fatigue, Boredom &Monotony. -. Role of these factors in accident causation and techniques to remove ill effects due to them. - Human Behavior: Individual differences. Behavior as function of self and situation, perception of danger and risk. Knowledge and responsibility vis-à-vis safety performance-. Motivation for Safety: Need and Nature of Motivation. Theories of motivation and their application to safety. Role of Management, Supervisors and Safety Department in motivation. Behavior based safety (BBS) Management Program.			
Unit 2:Theory: SHE MANAGEMENT & PLANNING FOR SAFETY:- Planning: Definition, purpose, nature, scope and procedure.- Range of planning & variety of plans.- Strategic planning and tools of implementation.- MBO i.e. Management by objectives and its role in Safety, Health and Environment (SHE).- Safety Policy – Formulation and implementation. Statutory provisions. ORGANIZING FOR SAFETY:.- Organizing: Definition, need, nature and principles. - Organizing for Safety or SHE Department.-. Types, structure, functions and responsibilities.- Line and Staff Functions for SHE.-Role of Supervisors, Workers and	20%	18 hours	Presentation, Video presentation Chalk board Notes

Trade Unions.- .DIRECTING FOR SAFETY:-Direction: Definition, process, principles and techniques, Leadership: Role, functions and attributes of a leader, Leadership styles in safety management.- Communication: Purpose, process, types and channels, Essential rules in communication, Two-way communication, Barriers in communication, Essentials of effective communication, Communication and group-dynamics. Team building.			
Unit 3**:.** **CONTROLLING FOR SAFETY: -**Controlling: Definition, need, benefits, types, areas, elements and controltechniques -.MBE i.e. Management by Exception. - Monitoring by Safety Standards.-. Application and use of Indian Standards on Safety and Health:IS:14489 and IS:15001, OHSAS 18001.-. ILO and EPA Standards. **SAFETY EDUCATION AND TRAINING: -**Assessment of Training: Elements of training cycle,Assessment of training needs,Objectives of training program.- Techniques of training, Design and development of training programs,Training methods and strategies.- Types of safety training, Evaluation and review of training programs,Modern methods of training,Modern teaching aids, Integration of safety training with job training,- Competence Building Technique (CBT),Concept for training. Safety as on-line function,Role of Multimedia and Communication, Applications of Computers,Relevance of WTO regarding SHE.	20%	14 hours	Presentation, Video presentation Chalk board Notes
Unit 4: EMPLOYEE PARTICIPATION IN SAFETY: Employee Participation: Purpose, Areas and Methods of participation, Workers' and Union's participation.Safety Promotion and Publicity: Safety suggestion schemes,Safety competitions,Safety incentives schemes,Audio-visual publicity and other promotional methods,Safety Performance Awards and Recognition.-. Safety Committee:Structure, functions, meetings, minutes and implementationof its own remarks. Statutory provisions.-. Approaches to Compliance and Violations. **ECONOMICS OF SAFETY:** Cost of accidents: Direct and Indirect costs and their	20%	10 hours	Presentation, Video presentation Chalk board Notes

ratio,Usefulness to convince management.-. Financial costs: Financial costs to individual, his family, organization and society, Cost compilation procedure,Utility and limitations of cost data.-.Budgeting for safety,Purpose and procedure of safety budgeting,Consideration of Performance Rates.			
Unit 5: MANAGEMENT INFORMATION SYSTEM:-. Sources of information on Safety, Health and Environment Protection,.Compilation and collation of information, its analysis and use,"Benchmarking" for safety performance.-.Modern methods of programming,Storing and retrieval of MIS for SHE,Computer Software Application and Limitations. Causes of MISfailure. Advantages and disadvantages of computerized information system. Status and future goals of computer utilization in SHE services inindustries.Integration between departmental MIS.	20%	8 hours	Presentation, Video presentation Chalk board Notes

LEARNING RESOURCES

TEXTBOOKS	• Handbook of Industrial Safety by K.U. Mistry, SiddarthPrakashan, 108, Western Plaza, Near BhulkaBhavan School, Adajan Road, Surat – 395 009. (Gujarat).
REFERENCE BOOKS	1. Accident Prevention Manual for Industrial Operations, National Safety Council,425, North Michigan Ave, Chicago, Illinois, USA. 2. Encyclopaedia of Occupational Health and Safety, Fourth Edition, ILO, Geneva. 3. Safety and Health for Engineers, by Roger L Brauer, Van Nostrain Reinhold, New York. 4. Loss Prevention in the Process Industries, Frank P Lees, Butterworth Heinemann. 5. Safety At Work by John Ridley. 6. Handbook of Industrial Safety by K.U. Mistry, SiddarthPrakashan, 108, Western Plaza, Near BhulkaBhavan School, Adajan Road, Surat – 395 009. (Gujarat). 7. Industrial Accident Prevention by H.W. Heinrich, McGraw Hill Book Co. 8. Techniques of Safety Management by Dan Pederson. 9. Effective Safety and Health Training by Hilyer.

	10. Occupational Health and Safety by Confer. 11. . Environmental Health & Safety Management.Nicholas Cheunisinoff& Madelyn Graffia.Original Publishers: Noyes Publications.Indian Reprint: Jaico Publishing House. 12. Safety Management. John V Grimaldi& Rollin H Simonds Publication: All India Traveller Book Seller, Delhi.Industrial Safety and Health Management – II Edition. C. Ray Asfahl. Publication: Prentice Hall, Englewood Chliffs, New Jersey 07632. 13. Safety Thoughts by Loss Prevention Association of India Ltd. 14. . Responsible Care – A Public Commitment by Indian Chemical Manufacturers Association. 15. . Human Factors Engineering by McCormick E.J., McGraw Hill, New York. 16. Industrial Safety Management by Tarafdar.
Journals & Periodicals:	**NIL**
Other Electronic Resources:	**NIL**

Evaluation Scheme	**Total Marks 100 marks**	
Mid semester Marks	30 marks	
End Semester Marks	50 marks	
Continuous Evaluation Marks (20 Marks)	**CATEGORY**	**MARKS**
	Attendance	5 MARKS
	Quiz	5 MARKS
	Skill enhancement activities / case study	5 MARKS
	Presentation/ miscellaneous activities	5 MARKS
	1. Student will understand the basic concept of safety and its development process up to the modern	

Course Outcomes	concept of SHE i.e. Safety, Health and Environment.
	2. Student will understand concept of safety, problems of industrial accidents, safety technology, safety philosophy, safety psychology, principles of general management and their applicability to the safety management.
	3. Student will understand the managerial functions of safety planning, organizing, directing and controlling for industrial safety activities.
	4. Student will understand safety management techniques of education and training, motivation and participation of employees in safety, costs calculation of accidents
	5. relevance to safety budget and finally the MIS for safety.

BTFS302	**Legislations related to Safety, Health Environment & Fire**	**L**	**T**	**P**	**C**
		3	**0**	**0**	**3**
Total Credits: 3	**Total Hours in semester : 45 hrs**		**Total Marks:100**		
1	**Course Pre-requisites:** Safety Management -1				
2	**Course Category: Core Courses**				
3	**Course Revision/ Approval Date:23rd June 2020**				
4. **Course Objectives :**					
1	To learn all applicable important legislation from Safety, Health, Environment, fire prevention and protection point of view.				
2	To understand the applicability of statutory requirements to different type of industries.				
Course Content		**Weightage**	**Contact hours**	**Pedagogy**	

Unit 1:Theory: The importance & relevance of Factories Act 1948, Gujarat Factories rules 1963 .	20%	10 hours	Presentation, Video presentation, Chalk board, Notes
Unit 2:Theory: The importance & relevance of Indian Explosive Act 1884 and Explosive rules, Gas Cylinder Rules 2004, Petroleum Act 1934 with Rules 2002, Calcium Carbide Rules 1987. Static & Mobile Pressure Vessel Rules. Fire prevention Legislations. Fire Insurance Assessment. Fire Prevention & Life Safety Measures Act 2013 and Rules 2016.	20%	10 hours	Presentation, Video presentation, Chalk board Notes
Unit 3: Theory :The importance & relevance of Environment (Protection) Act 1986, MSIHC Rules. Water (Prevention and Control of Pollution) Act. Air (Prevention and control of pollution) Act. Chemical Accidents (Emergency, Planning, preparedness and response) Rules 1996	20%	10 hours	Presentation, Video presentation,Chalk board,Notes
Unit 4: Theory : The importance & relevance of Other Important Legislations:Boilers Act 1923, Electricity Act 2003 with rules, Public Liability Act 1991, Dock workers (Safety, Health & Welfare) Act. Safety & Health provisions of Building & other construction workers (R.E.C.S.) Act 1986 and central rules 1998 and Mines Act.	20%	10 hours	Presentation, Video presentation,Chalk board,Notes
Unit 5: Theory: Role & responsibilities of Regulatory authorities like DISH, PESO, GPCB & CPCB**.**	20%	5 hours	Presentation, Video presentation, Chalk board,Notes

LEARNING RESOURCES

TEXTBOOKS	• Factories Act – 1948 & Gujarat Factories Rules – 1963 with latest amendment • Environment Protection Act • Petroleum Acts & Rules • Boiler Acts

	• Electricity Acts & Rules • Public Liability Insurance Act • Building & other Construction workers Act 1986 • Calcium Carbide Rules
REFERENCE BOOKS	**NIL**
Journals & Periodicals:	**NIL**
Other Electronic Resources:	**NIL**

Evaluation Scheme		**Total Marks 100 marks**
Mid semester Marks	30 marks	
End Semester Marks	50 marks	
Continuous Evaluation Marks (20 Marks)	**CATEGORY**	**MARKS**
	Attendance	5 MARKS
	Quiz	5 MARKS
	Skill enhancement activities / case study	5 MARKS
	Presentation/ miscellaneous activities	5 MARKS
	• Students will be able to understand significance of Factories Act and Rules in Safety Engineering	
	• Students will be able to understand provisions related fire prevention and protection in different laws.	

Course Outcomes	• Students will be able to understand provisions and rules related to pollution control in important legislation.
	• Students will be able to know other important legislation from safety, fire prevention and protection point of view.
	• Students will be able to understand provisions related to fire prevention and protection in fire service act and rules.

BTFS303	**Town Planning and Building Design**	**L**	**T**	**P**	**C**
		3	**0**	**2**	**4**
Total Credits: 4	**Total Hours in semester :45 hrs +30 hrs**		**Total Marks:100**		

1	**Course Pre-requisites:** Engineering Graphics
2	**Course Category: other Discipline Core Courses**
3	**Course Revision/ Approval Date:23rd June2020**
	4. **Course Objectives :**
1	To study Civil Engineering Drawing related to construction of single storied buildings.
2	To study double storied residential buildings, public buildings and other simple civil engineering structures.
3	To study skill of preparing drawings of various types like Public buildings.
4	To study building and town planning and their development controls.

5	To study orthographic, perspective, working drawings etc.

Course Content	Weightage	Contact hours	Pedagogy
Unit 1:Theory: Types of Drawing: Appropriate scale & uses index map- key plan-village map-site plan-layout plan -Types of Projection adopted in Building Drawing .Symbols- Conventions and Abbreviations for - Electrical fittings- water supply-sanitary fittings- material for construction etc. Sizes of various standard papers-Introduction to buildings- Type of buildings-Building Services – Introduction of Building Services like water supply and drainage-electrification -ventilation and lightening and staircases - fire safety- thermal insulation- acoustics of buildings. **Practical 1** Four A1 Size Drawing sheet: Residential Planning: Single storied Building: Plans, elevation, section, lay-out plan, key plan, site plan, area table, schedule of opening.Scale-1:100**.**	20%	8 hours +6 hours	Presentation, Video presentation,Chalk board,Notes
UTheory :-**Principles of Building planning:** Principles of architecture composition Building by–laws as per National Building Code, Standards for residential buildings, Building by–laws of local authority, standards for industrial, public, commercial and institutional buildings Preparing working drawing of residential building, software application in planning, detached, semidetached, row houses and apartments with scale proportion, open spaces standard as per F.S.I. permissible- Elements of perspective views-Types of views such as one point, two point perspective etc. **Practical 2:** Residential Planning: Two storied Building: Plans, elevation, section, lay-out plan, key plan, site plan, area table, schedule of opening.Scale-1:100**.**	20%	12 hours + 6hours	Presentation, Video presentation Chalk board Notes
Unit 3: Town planning: Planning surveys-selection of site for urban development- consideration cliats- Topography- Drainage and water supply etc. Types of roads in urban areas communication system and it	20%	12 hours +6 hours	Presentation, Video presentation Chalk board

relationship to the cities. Multi story flats,-Group Housing- Group Ware Housing-Commercial complexes-and Detached and Semidetached houses in relation to fire risk-Types of housing units- Layout of Housing areas with consideration of site orientation,-views and architectural aesthetics **Practical 3:**Public Building school plan: Ground Floor plan, typical floor plan, elevation, section, lay-out plan, key plan, site plan, area table, schedule of opening.			Notes
Unit:-4 :Theory:-Hazard, Risk and Vulnerability analysis in town planning, Risk informed town planning Fundamental principles of Town Planning- Land use Planning and percentage of different Land uses as per category of town-Components of town such as Zones-Road Network- CBD-Neighborhood planning-Development controls for new town planning schemes for growth negotiation Formation of Slums-Reasons of Slum formation-and remedial measures for avoiding slum foundation. Introduction to smart city- its Characteristics as per present Scenario. **Practical 4:**Public Building public health center plan: Ground Floor plan, typical floor plan, elevation, section, lay-out plan, key plan, site plan, area table, schedule of opening.	20%	8hours + 6hours	Presentation, Video presentation Chalk board Notes
Unit 5: Theory:-Case study on town planning: Design of Public Buildings- Consideration in planning of schools- Colleges & Libraries-Consideration in planning of Hospitals- Hotels- Consideration in planning of Cinema Theatres-office buildings- Consideration in planning of markets-High rise Buildings etc. **Practical 5:**Working Drawing: sheet should accommodate min. six types with sectional details. (Furniture plan, Drainage lay out, Toilet Detail, Wood work detail, Kitchen detail, Electrical plan etc) **.**Perspective Drawing: Two point perspective of sheet -1 planning. (B) Assignments: (1) Assignment -1: Principles of Planning & Architecture (2) Assignment -2: Building Bye laws (3) Assignment -3: Town Planning**.**	20%	5 hours +6 hours	Presentation, Video presentation,Chalk board,Notes
LEARNING RESOURCES			

TEXTBOOKS	1. Town Planning by G. K. Hiraskar 2. National Building Code-2005, New Delhi 3. Building Planning, Designing and scheduling by Gurucharan Singh, Standard Book House, New Delhi 4. General Development Control Regulations published by AUDA and GICEA
REFERENCE BOOKS	5. Town Planning by S.C. Rangwala, Charotar publishing House, Anand 6. Accident prevention manual for Industrial operations, NSC, Chicago, 1982. Fulman, J.B., Construction Safety, Security & Loss Prevention, John Wiley and Sons, 1979 7. Town Planning by S.C. Rangwala, Charotar publishing House, Anand 8. Accident prevention manual for Industrial operations, NSC, Chicago, 1982. Fulman, J.B., Construction Safety, Security & Loss Prevention, John Wiley and Sons, 1979.
Journals & Periodicals:	**NIL**
Other Electronic Resources:	**NIL**

Evaluation Scheme	**Total Marks 100 marks**	
Mid semester Marks	30 marks	
End Semester Marks	50 marks	
Continuous Evaluation Marks (20 Marks)	**CATEGORY**	**MARKS**
	Attendance	5 MARKS
	Quiz	5 MARKS
	Skill enhancement activities / case study	5 MARKS

	Presentation/ miscellaneous activities	5 MARKS
Course Outcomes	1. Comprehend local building bye-laws and provisions of National Building Code in respect of building and town planning	
	2. Discuss various aspects of principles of planning and architecture in planning building and mass composition	
	3. Explain the principles of planning and design considerations to construct earthquake resistant building	
	4. Prepare working drawings, foundation plans and other executable drawings with proper details for residential buildings	
	5. Understand the importance of design through various well known case studies	

BTFS304	**Strength of Materials**	**L**	**T**	**P**	**C**
		3	**0**	**2**	**4**
Total Credits: 4	**Total Hours in semester :45 hrs +30 hrs**		**Total Marks:100**		

1	**Course Pre-requisites: Engineering Mechanics**
2	**Course Category: other Discipline Core Courses**
3	**Course Revision/ Approval Date:23rd June 2020**
4. **Course Objectives :**	
1	To introduce to continuum mechanics and material modelling of engineering materials based on first energy principles
2	To study deformation and strain;
3	To study momentum balance, stress and stress states
4	To study elasticity and elasticity bounds
5	To study plasticity and yield design

Course Content	Weightage	Contact hours	Pedagogy
Unit 1: **Simple Stresses and Strains:** Concept of stress and strain, St. Venant's principle, stress and strain diagram,Elasticity and plasticity – Types of stresses and strains, Hooke's law – stress – strain diagram for mild steel – Working stress – Factor of safety – Lateral strain, Poisson's ratio and volumetric strain – Elastic moduli and the relationship between them – Bars of varying section – composite bars – Temperature stresses. Strain Energy – Resilience – Gradual, sudden, impact and shock loadings – simple applications. Practical 1: **1.Tesion test on MS and Cast iron specimen** **2.Bending test on simply supported and cantilever beam**	20%	9 hours +4 hours	Presentation, Video presentation Chalk board Notes
Unit 2: Compound Stresses and Strains: Two dimensional system, stress at a point on a plane, principal stresses and principal planes, Mohr circle of stress, ellipse of stress and their applications. Two dimensional stress-strain system, principal strains and principal axis of strain, circle of strain and ellipse of strain. Relationship between elastic constants. Practical 2: **1.Compression test on concrete cube** **2.Impact test** **3.Assignment**	15%	6 hours +8 hours	Presentation, Video presentation,Chalk board Notes
Unit 3: Bending moment and Shear Force Diagrams: Bending moment (BM) and shear force (SF) diagrams.BM and SF diagrams for cantilevers simply supported and fixed beams with or without overhangs. Calculation of maximum BM and SF and the point of contra flexure under concentrated loads, uniformly distributed loads over the whole span or part of span, combination of concentrated loads (two or three) and uniformly distributed loads, uniformly varying loads, application of moments	25%	12 hours +6 hours	Presentation, Video presentation Chalk board Notes

Practical 3 **1.Shear test** **2.Assignment**			
Unit:-4 Flexural Stresses& shear stresses: Theory of simple bending – Assumptions – Derivation of bending equation: M/I = f/y = E/R - Neutral axis – Determination of bending stresses – Section modulus of rectangular and circular sections (Solid and Hollow), I,T, Angle and Channel sections – Design of simple beam sections. Shear Stresses- Derivation of formula – Shear stress distribution across various beam sections like rectangular, circular, triangular, I, T angle sections. Practical 4: **1.Determination on torsion and deflection** **2.Hardness test** **3.Assignment**	15%	6 hours +8 hours	Presentation, Video presentation Chalk board Notes
Unit 5: Torsion& thin cylinders: Derivation of torsion equation and its assumptions. Applications of the equation of the hollow and solid circular shafts, torsional rigidity, Combined torsion and bending of circular shafts. Derivation of formulae and calculations of hoop stress, longitudinal stress in a cylinder, and sphere subjected to internal pressures **Spring test(2 hour)** **Assignment**	25%	12 hours +4 hours	Presentation, Video presentation Chalk board Notes

LEARNING RESOURCES

TEXTBOOKS	1. Textbooks: Strength of materials by Dr. R.K. Bansal. 2. Ramamrutham,S, Strength of materials, DhanpatRai, New Delhi. 3. Strength of Materials by R. Subramanian, Oxford University Press, New Delhi. 4. Bhavikatti S S “Strength of Materials”, Vikas Publication House, New Delhi,2007
REFERENCE BOOKS	5. Timoshenko, S. and Young, D. H., “Elements of Strength of Materials”, DVNC, New York, USA.

	6. Hibbeler, R. C. Mechanics of Materials. 6th ed. East Rutherford, NJ: Pearson Prentice Hall, 2004 7. Mechanics of Materials - Ferdinand P. Beer, E. RusselJhonston Jr., John T. DEwolf – TMH 2002. 8. Egar P. Popov &ToaderA .Balan "Engineering Mechanics of Solids" 2nd Edition, Pretice Hall of India Pvt Ltd, New Delhi, 2002. .
Journals & Periodicals:	**NIL**
Other Electronic Resources:	**NIL**

Evaluation Scheme	**Total Marks 100 marks**	
Mid semester Marks	30 marks	
End Semester Marks	50 marks	
Continuous Evaluation Marks (20 Marks)	**CATEGORY**	**MARKS**
	Attendance	5 MARKS
	Quiz	5 MARKS
	Skill enhancement activities / case study	5 MARKS
	Presentation/ miscellaneous activities	5 MARKS
Course Outcomes	1. Describe the concepts and principles, understand the theory of elasticity including strain/displacement and Hooke's law relationships; and perform calculations, relative to the strength and stability of structures and mechanical components.	
	2.Define the characteristics and calculate the magnitude of combined stresses in individual members and complete structures.	
	3. Analyze solid mechanics problems using classical methods and energy methods	
	4.Analyze various situations involving structural members subjected to combined stresses by application of Mohr's circle of stress; locate the shear center of thin wall beams.	

	5.Solve torsion problems in bars and thin walled cylinders and spheres

BTFS305	Automobile Engineering & Safety	L	T	P	C
		3	0	0	3
Total Credits: 4	**Total Hours in semester :45 hrs**		**Total Marks:100**		

1	**Course Pre-requisites:** Engineering Fundamentals'
2	**Course Category:** Other discipline Core Courses
3	**Course Revision/ Approval Date:23rd June 2020**

4. **Course Objectives :**

1	To understand the basic concept of Engine classification and types gear box
2	To understand the basic concept of differential systems
3	To understand the basic concept of Electrical system of Heavy vehicle.
4	To understand lubrication/cooling systems of heavy vehicle and special requirements for Firefighting vehicles
5	To understand concept of automobile safety study and important Indian Motor Vehicle Act and rules.

Course Content	Weightage	Contact hours	Pedagogy

Unit 1:Theory: ENGINES: Engine Classification, construction, details of Engine Components. Combustion in S.I. Engines, Combustion in C.I. Engines, Study of fuel system components. Function of carburettors, construction details, Type of Study of diesel fuel feed systems. Carbureaion and mass distribution of mixture, supercharging, fuel injection and injection sections. Clutch, Types, Construction, Operation and Fault finding of clutches. Transmission assembly Types of Gear box, Transfer of gear box, operation and maintenance of gear box.	20%	10 hours	Presentation, Video presentation Chalk board Notes
Unit 2:Theory: Differential Necessity, Construction of differential systems. Axles, Types and Application. Brakes, Types, Construction and Operation of Hydraulic, Pneumatic Brake Systems, Maintenance of Brakes. Suspension, Necessity, Types, Construction and operation, Shock absorber, Coil springs, Independent suspension, Hotchkiss drive, Torque tube drive. Steering, Systems, Constructional details, types of steering gear box, steering geometry, caster, camber, king pin inclination, Effect of steering geometry on directional stability, Power steering Lubrication systems. Types, classification of systems. Lubricants. Cooling System – Air cooling, components, and working of cooling systems.	20%	10 hours	Presentation, Video presentation,Chalk board Notes
Unit 3**: Theory** :Electrical System. Ignition Systems, Magnet ignition, Battery Ignition, Electronic Ignition, Merits and Demerits, Working, Self Starter, Dynamo voltage regulator, Battery construction, operation and maintenance. Pollution. Air-Pollution, Euro norms, Pollution Control techniques.	20%	10 hours	Presentation, Video presentation,Chalk board,Notes
Unit 4: Lubricating System: Types, Components, Lubricating oil; Cooling System, covering details of different components and systems. Typical wear and tear and effects on system performance. Special arrangements and accessories for Fire Fighting vehicles, such as PTOs, etc, and their application. Use of hydraulic and electrical systems for	20%	8 hours	Presentation, Video presentation,Chalk board,Notes

firefighting applications.			
Unit 5: Automobile Accidents, CMV Rules regarding safety devices for Drivers, Passengers, Fire fighting vehicles & Appliances. Rules & regulations of RTO. Laboratory testing of vehicles. Road testing of vehicles.	20%	7 hours	Presentation, Video presentation,Chalk board,Notes

LEARNING RESOURCES

TEXTBOOKS	• Wills H. Crouse, Automobile chassis and body construction, • Operation and Maintenance, Tata McGraw Hill 1976 • Dr. D.S. Kumar, Automobile Engineering, S.K. Kataria& Sons 2015
REFERENCE BOOKS	• Arther V. Judge, Modern Petrol Engine 1975 • A.T. Walford, Ergonomies of Automation • 1989 S.Adhey, Bormh Practical Automobile Engineering Illustrated, Asia Publishing House, 1983 • G.B.S. Narrang, Automobile Engineering, Khanna Publisher • R.B. Gupta, Automobile Engineering, Satya Prakashan 2015 R.P. Sharma, • A Course in Automobile"Engineering, Dhanpat Rai & Sons
Journals & Periodicals:	**NIL**
Other Electronic Resources:	**NIL**

Evaluation Scheme	**Total Marks 100 marks**
Mid semester Marks	30 marks
End Semester Marks	50 marks

Continuous Evaluation Marks (20 Marks)	**CATEGORY**	**MARKS**
	Attendance	5 MARKS
	Quiz	5 MARKS
	Skill enhancement activities / case study	5 MARKS
	Presentation/ miscellaneous activities	5 MARKS
Course Outcomes	1. Students will be gain understanding of basic vehicle systems i.e. different types of engines, differential systems, gear boxes, steering and control mechanism system.	
	2. Students will be able to identify the other important vehicle systems such as electrical, hydraulic and pneumatic systems and describe their functions..	
	3. To understand lubrication/cooling systems of heavy vehicle and other special requirements for Firefighting vehicles.	
	4. To appreciate the important and specific requirements and systems for Firefighting vehicles	
	5. Students will be able to understand and gain familiarity with important applicable regulations and rules related to automobile safety.	

Fourth Semester

SEMESTER 4													
Sr No	Course Code	Course Name	TEACHING SCHEME					EXAM SCHEME					
								THEORY MARKS			PRACTICAL		TOTAL
			L	T	P	C	Hrs/week	CE	MID SEM	END SEM	LAB WORK	LAB EXAM	
1	20BTFS401	Rescue techniques & equipment	2	0	2	3	4	20	30	50	20	30	150
2	20BTFS402	Building fire prevention & protection measures	3	0	2	4	5	20	30	50	20	30	150
3	20BTFS403	Hazards identification, risk assessment and control techniques	3	1	0	4	4	20	30	50	-	-	100
4	20BTFS404	Safety in Construction Industry	3	0	0	3	3	20	30	50	-	-	100
5	20BTFS405	Machine Design	3	1	0	4	4	20	30	50	-	-	100
6	20BTFS406	Pumping Machinery & Fluid mechanics	3	0	2	4	5	20	30	50	20	30	150
TOTAL						**22**	**25**	**TOTAL MARKS**					**750**

MS - Mid Semester, ES - End Semester, CE - Continuous Evaluation, LW - Laboratory Work, LE - Laboratory Exam

BTFS401	RESCUE TECHNIQUES & EQUIPMENT	L	T	P	C
		2	0	2	3
Total Credits: 3	Total Hours in semester :30 hrs + 30hrs		Total Marks:100		

1	**Course Pre-requisites: Nil**
2	**Course Category: Core Courses**
3	**Course Revision/ Approval Date:23rd June 2020**

4. **Course Objectives :**

1	To provide fundamental understanding of different rescue actions required and techniques adopted in ordinary and extraordinary accidents, including disasters.
2	To become familiar with critical body systems, and trauma/first aid required for common rescue situations.
3	To understand function and working of different tools and respiratory and non respiratory Personal Protective Equipment used by rescuers in emergencies.
4	Understand use and function of specialized rescue equipment used by emergency responders in emergencies.
5	To introduce different electric, hydraulic, and pneumatically operated rescue tools and equipment commonly used in emergencies

Course Content	Weightage	Contact hours	Pedagogy
Unit 1:Theory: The purpose and understanding of different rescue actions applied in emergencies. Become familiar with fundamental actions and techniques applied for rescue of victims in fire and other similar emergencies (Fires, Lift accidents, Car accidents, etc). **Practical:** -	20%	6 hours	Presentation, Video presentation Chalk board Notes

Unit 2:Theory: Critical human body systems, with focus on respiratory and cardio-pulmonary systems. Familiarization with respiratory protective apparatus - Gas masks, Breathing Apparatus sets - types, constructional features, working principle and applications, calculation of the capacity & time duration of the B.A.set. **Practical:** - B.A. Practicals& CPR Drills	20%	6 hours	Presentation, Video presentation,Chalk board Notes
Unit 3**: Theory** : Special rescue techniques applied for extraordinary hazards and accidents such as building collapse, trenches, sewers, machinery, etc. Recognize important allied functions required (such as trauma care, triage) in large scale emergencies/ disasters.	20%	6 hours	Presentation, Video presentation,Chalk board,Notes
Unit 4: Standard rescue equipment used by Fire Services - Different types of ladders, turntable ladders, hydraulic platforms; their constructional features and applications. Ropes and rope rescue; different types of knots & hitches and their applications in emergency. Different Carries & Drags: - Fireman carry, Two man carry, three man carry, chair carry, Stretcher carry and different types of Drags. **Practical:** On Ground Practicals& drills	20%	6 hours	Presentation, Video presentation,Chalk board,Notes
Unit 5: Overview of different electric, hydraulic, and pneumatically operated rescue tools and equipment commonly used in emergencies- Hydraulic Jack, Hydraulic Cutter, Hydraulic Expander, Air Lifting Bags, Electric Cutter, Electric Saw, Chain saw etc. **Practical:**Visit to Industrial/ Specialized Fire Service to witness special tools and their operation.	20%	6 hours	Presentation, Video presentation,Chalk board,Notes

LEARNING RESOURCES

TEXTBOOKS	1. Fire Service Manual Volume 2 Incidents Involving Rescue from Road Vehicles, HMSO Publications 2. Practical Firemanship II, Manual of Firemanship, HMSO Publications 3. Manual of Firemanship, Book 5, Ladders & Appliances, HMSO Publications 4. Elementary principles of rescue by Govt. Of India, Ministry of Home Affairs

	5. Product Data sheets & Operation/Maintenance Manuals for Rescue Equipments
REFERENCE BOOKS	1. Rescue –Civil Defense Handbook by HMSO 2. Relevant ISI standards - Special appliances and equipments
Journals & Periodicals:	**NIL**
Other Electronic Resources:	**NIL**

Evaluation Scheme	**Total Marks 100 marks**	
Mid semester Marks	30 marks	
End Semester Marks	50 marks	
Continuous Evaluation Marks (20 Marks)	**CATEGORY**	**MARKS**
	Attendance	5 MARKS
	Quiz	5 MARKS
	Skill enhancement activities / case study	5 MARKS
	Presentation/ miscellaneous activities	5 MARKS
Course Outcomes	1. Students will become aware of different rescue actions required and techniques adopted in ordinary and extraordinary accidents, including disasters.	
	2. Students will become familiar with critical body systems, their functions and trauma/first aid required for common rescue situations.	
	3. Students will understand function and working of different tools as well as respiratory and non respiratory	

	Personal Protective Equipment used by rescuers in emergencies.
	4. Students will be exposed to the need and function of specialized rescue equipment used by emergency responders in emergencies, and their technical specifications.

BTFS402	BUILDING FIRE PREVENTION & PROTECTION MEASURES	L	T	P	C
		3	0	2	4
Total Credits: 4	Total Hours in semester :45 hrs + 30 hrs		Total Marks:100		

1	**Course Pre-requisites:** Town Planning & Building Design
2	**Course Category: Core Courses**
3	**Course Revision/ Approval Date:23rd June 2020**

4. **Course Objectives :**

1	To provide fundamental understanding of Building design with respect to fire and life safety.
2	Understand building occupancies and their characteristics and how these influence fire safety design aspects.
3	Recognize the importance of fire prevention in buildings and how this is achieved in practice.
4	Become familiar with life safety and fire protection arrangements in buildings and their design aspects.
5	Introduce students to basic code requirements/ rules for buildings, which need to be applied from fire safety point of view.

Course Content	Weightage	Contact hours	Pedagogy

Unit 1:Theory: General Principles of Fire Prevention and Protection: Occupancy classification of buildings and their characteristics. Zoning of city areas. Site requirements, type of construction required with respect to fire resistance, fire separation, compartmentation, isolation.	20%	8 hours	Presentation, Video presentation, Chalk board, Notes
Unit 2:Theory: Internal Planning and layout of Building Services and systems, hazardous areas and pipelines, vessels and equipment, and fire prevention measures provided. Fire prevention measures for different building systems i.e. electrical, HVAC, service ducts, fuel gas supply. Structural fire safety, compartmentation and segregation of hazardous areas. **Practical:** Special lecture/interaction with practicing Architects	20%	12 hours	Presentation, Video presentation, Chalk board Notes
Unit 3**: Theory** : Different factors affecting safe egress from buildings in an emergency and how building codes address these factors. Code requirements for safe egress design, including associated systems such as emergency lighting, signage, smoke control, etc. Design of egress components i.e. doors, stairs, ramps and code requirements **Practical:** Special lecture/interaction with practicing Architects	20%	12 hours	Presentation, Video presentation,Chalk board,Notes
Unit 4: Theory : Common fire protection systems for buildings: Portable extinguishers, Rising mains-wet & dry, sprinkler systems, drenchers, etc – their applicability and requirement as per building codes. Special systems such as water spray systems, clean agent, foam systems, water mist, etc. **Practical**: Site visit to building complex to see different systems.	20%	8 hours	Presentation, Video presentation,Chalk board,Notes
Unit 5: Theory: Fire Safety management and emergency response organization for buildings. Importance of Emergency plans, roles and responsibilities of various teams, drills and evaluation, etc.	20%	5 hours	Presentation, Video presentation,Chalk board,Notes

LEARNING RESOURCES

TEXTBOOKS	1. Fire Service Manual Volume 3 Fire Safety, Fire Protection of Buildings, HMSO Publications 2. Dr. Than Singh Sharma, Fundamentals in building design.

	3. National Building code of India 2016, Part-4, BIS 4. NFPA Fire protection Handbook, Section 1, 20th Edition.
REFERENCE BOOKS	1. Barendra Mohan Sen, Fire protection and prevention the essential handbook, UBS publishers. 2. Lon H. Ferguson, Fundamentals of Fire Protection for the Safety professional, The scarecrow Press, Inc. 3. Hurley, Morgan, Section 1, SFPE Handbook, SFPE/NFPA, USA
Journals & Periodicals:	**1.** Journals & Periodicals: IFP (IFE(UK) Journal), Fire Engineer (IFE (India) Journal), Fire Protection Engineering (SFPE)
Other Electronic Resources:	**NIL**

Evaluation Scheme	**Total Marks 100 marks**	
Mid semester Marks	30 marks	
End Semester Marks	50 marks	
Continuous Evaluation Marks (20 Marks)	**CATEGORY**	**MARKS**
	Attendance	5 MARKS
	Quiz	5 MARKS
	Skill enhancement activities / case study	5 MARKS
	Presentation/ miscellaneous activities	5 MARKS
	1. Students will understand importance of different design features of building from a fire and life safety point of view.	

Course Outcomes	2. Students will be able to explain classification of buildings and code requirements such as construction elements, building services and features based on occupancy.
	3. Students will able to explain concepts related to fire prevention in buildings, and associated features/ systems.
	4. Students will understand concepts related to life safety and fire protection as applied in buildings and how they are applied in practice.
	5. Students will become familiar with code requirements/rules applied for fire & life safety design in building.

BTFS403	**HAZARDS IDENTIFICATION, RISK ASSESSMENT AND CONTROL TECHNIQUES**	**L**	**T**	**P**	**C**
		3	**1**	**0**	**4**
Total Credits: 4	**Total Hours in semester :45hrs + 15 hrs**		**Total Marks:100**		

1	**Course Pre-requisites:** Safety Management -1
2	**Course Category: Core Courses**
3	**Course Revision/ Approval Date:23rd June 2020**
4. **Course Objectives :**	
1	To understand Hazards Identification, Risk Assessment and Control Techniques.
2	To provide them with sufficient knowledge to prevent and control accidents by using various hazards identification and risk assessment techniques and control measures.
3	To understand Safety methodology of audit and inspection.

4	To understand preparation of Safety audit report.

Course Content	Weightage	Contact hours	Pedagogy
Unit 1:Theory: Hazards and Risks: a} Definitions& Terminology for hazard and risk assessment b}Difference between Hazard and Risk and their co-relation.c}Prioritization of hazards and risks.d} Hazard and Risk Progression Chart e} Hazard Identification, Hazard analysis, Risk analysis: Risk assessment, Risk management.	20%	10 hours	Presentation, Video presentation, Chalk board, Notes
2) **Unit 2:Theory: Hazard and Risk Analysis: a)** Quantitative and Qualitative Risk analysis b) Failure Mode and Effect Analysis (FMEA) c) Failure Mode, Effect and Criticality Analysis (FMECA) d) Maximum Credible Accident Analysis. Example of each e) Preliminary Hazard Analysis (PHA) & Hazard Analysis (HAZAN) f) Hazard and Operability study (HAZOP) g) Management Oversight Review Technique (MORT) h) Incident Recall Technique, Critical Incident Review Technique etc i) Use of Safety Audit and checklists for Hazard Analysis.	20%	18 hours	Presentation, Video presentation, Chalk board Notes
1. Unit 3**: Theory** : **Risk Assessment:** a) Comparing analyzed risks with Acceptable criteria (permissible limits) and giving Judgment for further Safety measures if necessary b) Variety of risks and assessment methods including FTA, ETA etc c) Use of Computer Models.	20%	14 hours	Presentation, Video presentation,Chalk board,Notes
Unit 4: Theory : **MAJOR ACCIDENT HAZARD (MAH) CONTROLS:** Concept of MAH: Definition of "Major Accident Hazard", Identification and assessment of MAH units. Criteria and Classification of Threshold Quantities of hazardous materials, Applicability of respective rules (MSIHC Rules or Rule 68-J, GFR),Compliance of statutory provisions.-Assessment of fire, explosion and toxicity by Dow &Mond index, Assessment of Reliability of vessels and safety fittings. Data of Failure rates and its utility.-Gas dispersion, Fire and Explosion Events, Assessment of probability (frequency) and consequence (effect) of such hazardous events. Scenario identification and Consequence Analysis. Computer modeling: Population density, Vulnerable zones, Probit equation & percentage fatality, Types of damage and damage distances. Risk	20%	10 hours	Presentation, Video presentation,Chalk board,Notes

counter-X and F-N curves, Criteria for acceptable risks, Assessment and Areas of Evacuation.			
Unit 5: Theory: Safety Audit, Safety Report and Risk Assessment Report,Preparation of Safety audit as per IS:14489,Preparation of Risk Assessment Report and its compliance, Preparation of Safety Report,Use of identified risks and scenarios from Safety Audit, Safety Report and Risk Assessment Report for emergency planning. Compliance,	20%	8 hours	Presentation, Video presentation,Chalk board,Notes

LEARNING RESOURCES

TEXTBOOKS	1. Handbook of Industrial Safety by K.U. Mistry, SiddarthPrakashan, 108, Western Plaza, Near BhulkaBhavan School, Adajan Road, Surat – 395 009. (Gujarat). 2. Chemical Process Safety Fundamentals with Applications by Daniel A Crawl & Joseph F Louvar, Prantice Hall, New Jersey.
REFERENCE BOOKS	1. Accident Prevention Manual for Industrial Operations, National Safety Council,425, North Michigan Ave, Chicago, Illinois, USA. 2. Encyclopaedia of Occupational Health and Safety, Fourth Edition, ILO, Geneva. 3. Safety and Health for Engineers, by Roger L Brauer, Van Nostrain Reinhold, NewYork. 4. Loss Prevention in the Process Industries, Frank P Lees, Butterworth Heinemann. 5. Occupational Safety Management & Engineering by Willi Hammer. 6. Safety At Work by John Ridley. 7. . Major Hazard Control – A Practical Manual, ILO, Geneva. 8. Effects and Damage Calculations of Accidents with Hazardous materials, M.Molag, T.N.O. Course Book – Risk Analysis, T.N.O. Apaldoorn, Netherlands. 9. Gas Dispersion Modeling, Engineers India Ltd., Central Labour Institute, Mumbai. 10. Methodologies for Risk & Safety Assessment in Chemical Process Industries, 11. Raghvan K.V., Khan A.K., Commonwealth Science Council, London. 12. Guidelines on Compilation and Assessment of a Safety Report for Major Accident

	13. Hazard Factories/Installations by Central Labour Institute, Sion, Bombay. 14. Technical Guidance on Hazard Analysis by National Safety Council. 15. IS 3786 Computation of Frequency and Severity Rates for Industrial Injuries and 16. Classification of Industrial Accidents. 17. IS 14489 Code of Practice for Occupational Safety & Health Audit. 18. The Workmen's Compensation Act 1923. 19. Emergency Preparedness by MOEF through ICMA publication.
Journals & Periodicals	**NIL**
Other Electronic Resources:	**NIL**

Evaluation Scheme	**Total Marks 100 marks**	
Mid semester Marks	30 marks	
End Semester Marks	50 marks	
Continuous Evaluation Marks (20 Marks)	**CATEGORY**	**MARKS**
	Attendance	5 MARKS
	Quiz	5 MARKS
	Skill enhancement activities / case study	5 MARKS
	Presentation/ miscellaneous activities	5 MARKS
	1. Student will understand types of accident and disablement, safety performance rates, accident reporting, analysis and investigation techniques, various safety appraisal and control techniques	
	2. Students will able to understand the concept of major accident hazard (MAH), criteria for classification of	

Course Outcomes	MAH units, assessment of fire, explosion and toxicity index,
	3. Students will able to understand the concept of failure rates and reliability data, gas dispersion and computer modeling, probability and consequence analysis, risk contours, F-X and F-N curves
	4. Students will able to prepare safety audit and risk assessment reports, on-site and off-site emergency plans and codes of practice for major accident hazard control
	5. Students will be able to deal with safety related issues of modern hazardous industries.

BTFS404	**SAFETY IN CONSTRUCTION INDUSTRY**	**L**	**T**	**P**	**C**
		3	**0**	**0**	**3**
Total Credits: 3	**Total Hours in semester :45 hrs**		**Total Marks:100**		
1	**Course Pre-requisites:** Fundamentals of Fire, Safety,Health &Environment.				
2	**Course Category: Core Courses**				
3	**Course Revision/ Approval Date:23rd June 3030**				
4. **Course Objectives :**					
1	Become familiar with different stages of building construction, and activities involved.				
2	To understand the hazards associated with specific activities associated with building construction and control procedures and safety practices currently employed.				
3	Become aware of safety and welfare legislation for construction workers and its implementation on sites.				

4	Appreciate the hazards involved in working at height and at depth, and become familiar with correct procedures, PPE and tools and tackles required for such rescue operations involving building construction sites
5	To learn various Occupational health and safety of workers at construction sites

Course Content	**Weightage**	**Contact hours**	**Pedagogy**
Unit 1:Theory: Understand the basic building design and construction process and the stages involved i.e. design, engineering, construction, commissioning and testing and handover. Building permit system, types of permit– initial, building occupation, testing and commissioning requirements and agencies involved. Different stages and activities involved in Construction operations: Underground works: - Excavation, drilling & blasting, trenching, strutting, piling & safety in using and operation machinery and equipment relating to above components. Above ground works: Scaffolding, Centering, Frame work, Ladders, Concreting wall and floor openings, staircases and railings. Structural steel work including welding, cutting erection etc. Safety in use of related machinery equipment. **Practical:** - Site visit	20%	10 hours	Presentation, Video presentation Chalk board Notes
Unit 2:Theory: Basic Philosophy of structural Soundness, accident and hazards – their causes & effect. Underground works- Excavation, drilling & blasting, trenching, strutting, piling & safety in using and operation machinery and equipment relating to above components. Above ground works - Scaffolding, Centering, Frame work, Ladders, Concreting wall and floor openings, staircases and railings. Structural steel work including welding, cutting erection etc. Safety in use of related machinery equipments. Safety measures with respect to building materials including cement, lime, timber, steel, glass, paints, varnishes, and petroleum products.	20%	18 hours	Presentation, Video presentation,Chalk board Notes
Unit 3**: Theory** : Safety in Demolition Operations: Planning & permit, Precautions prior to demolition. Protection of public. Precautions during demolition. Sequence of demolition operation from safety point. Safety measures with respect to building materials including coment,	20%	14 hours	Presentation, Video presentation,Chalk board,Notes

lime, timber, steel, glass, paints, varnishes, and petroleum products.			
Unit 4: Key Hazards and risks associated with working and rescue at height - nature of work, work site and environmental conditions. Safe systems of work – before, during and after work at height. Protective and rescue equipment used – webbing slings, lanyards, safety and work harnesses, ropes, categories of rope and rope control devices.	20%	10 hours	Presentation, Video presentation,Chalk board,Notes
Unit 5: Occupational health and safety of workers at construction sites - Occupational hazards & diseases. Personal protective equipment. Health & welfare measures. First aid facilities. Occupational health centers. Ambulance rooms. Medical examination. Salient Features of safety and Health in The Building & other Construction Workers (Regulation of employment and conditions of service) Act 1996 and central rules 1998 IS & NB codes).	20%	8 hours	Presentation, Video presentation,Chalk board,Notes

LEARNING RESOURCES

TEXTBOOKS	1. Fulman, J.B., Construction Safety, Security & Loss Prevention, John Wiley and Sons, 1979. 2. OSHA Construction Safety Handbook, 6th Edition, J. J. Keller & Associates 3. Fire Service Manual Volume 2, Safe Work at Height, HMSO Publications 4. Fire Service Manual Volume 3, Basic Principles of Building Construction, HMSO Publications 5. The Building and other construction workers (Regulation of Employment & conditions of service) Act 1996 and central rules 1998.
REFERENCE BOOKS	1. Accident prevention manual for Industrial operations, NSC, Chicago, 1982. 2. Fulman, J.B., Construction Safety, Security & Loss Prevention, John Wiley and Sons, 1979.
Journals & Periodicals:	**NIL**
Other Electronic Resources:	**NIL**

Evaluation Scheme		Total Marks 100 marks
Mid semester Marks	30 marks	
End Semester Marks	50 marks	
Continuous Evaluation Marks (20 Marks)	**CATEGORY**	**MARKS**
	Attendance	5 MARKS
	Quiz	5 MARKS
	Skill enhancement activities / case study	5 MARKS
	Presentation/ miscellaneous activities	5 MARKS
Course Outcomes	1. Students will be able to describe the different stages of building design & construction, and the regulatory process involved with different stages of the building process.	
	2. Students will understand the hazards associated with building construction activities and be able to describe important control procedures and safety practices.	
	3. Students will appreciate the occupational health and safety concerns of workers at construction sites, and understand procedures for control and monitoring.	
	4. Students will be recognize the hazards of working at height, and understand rescue procedures, and equipment required for such operations.	
	5. To Understand Occupational health and safety of workers at construction sites	

BTFS405	Machine Design	L	T	P	C
		3	1	0	4
Total Credits: 4	Total Hours in semester : 60 hrs		Total Marks:100		

1	**Course Pre-requisites: Engineering Graphics**
2	**Course Category: Other Department Core Courses**
3	**Course Revision/ Approval Date: 23rd June 2020**

4. **Course Objectives :**

1	Identify the national and international standards pertaining to machine drawing.
2	Apply limits and tolerances to assemblies and choose appropriate fits
3	Basic designing procedure
4	Design under static loading conditions
5	Design of riveted joint, welded joints, power screws, shafts, keys and couplings, pressure vessels etc.

Course Content	Weightage	Contact hours	Pedagogy
Unit 1:Theory: **1. INTRODUCTION**: Design engineering, basic requirements and procedure of design, design synthesis, selection of preferred sizes, aesthetic and ergonomic considerations in design, concurrent engineering, Standardisation & Codes **2. DESIGN CONSIDERATIONS**: Selection of manufacturing method, design and manufacturing considerations of casting, forging, machining and welding, design for manufacture and assembly.	20%	10 hours	Presentation, Video presentation, Chalk board, Notes

Unit 2:Theory: 1. **DESIGN AGAINST STATIC LOAD**: Modes of failure, factor of safety, types of loads and stresses, design of simple parts subjected to tension, compression, shear, bending, torsion and combined loads such as cotter joint, knuckle joint, levers, axle 2. **SCREWS AND THREADED FASTENERS**: Types of screw threads, Indian standard proportions, design of power screw, screw jack and C-clamp, bolt of uniform strength, bolt under tension, eccentrically loaded bolted joint in shear, eccentric load perpendicular and parallel to axis of bolt, selection of standard fasteners, design of turn buckle	20%	18 hours	Presentation, Video presentation, Chalk board Notes
Unit 3**: Theory** : 1. **WELDED JOINTS:** Advantages and limitations of welded joints, butt and fillet welds, stresses in butt and fillet welds, strength of butt, parallel and transverse fillet welds,axially loaded unsymmetrical welded joints, eccentric load in plane of welds, welded joints subjected to bending and torsional moments, welded joints subjected to fluctuating loads **2. RIVETED JOINTS**: Advantages and limitations of riveted joints, types of riveted joints, design of riveted joints, and efficiency of riveted joints.	20%	14 hours	Presentation, Video presentation,Chalk board,Notes
Unit 4: Theory : 1. **SHAFTS, KEYS AND COUPLINGS**: Shafts: types of shaft, material for shaft, standard sizes, , shaft design based on strength and rigidity, A.S.M.E. code for shaft design, Castigliano's theorem Keys: types of keys, design of sunk, saddle, tangent, Kennedy and round keys, design of splines Couplings: types of couplings, design of rigid and flexible couplings 2. **MECHANICAL SPRINGS**: Types, applications and materials for springs, stress and deflection equations for helical compression springs, Wahl's factor and its use in spring design, end conditions, surge in spring, springs in series and parallel, concentric springs, design of helical torsion, spiral and leaf springs, shot pinning	20%	10 hours	Presentation, Video presentation,Chalk board,Notes

Unit 5: Theory:. THIN AND THICK CYLINDERS: Classification, design of thick cylinders, Lame, Clavarino and Birnie equations, autofretage, compound cylinders subjected to internal and external pressure.	20%	8 hours	Presentation, Video presentation,Chalk board,Notes

LEARNING RESOURCES

TEXTBOOKS	1. Design of Machine Elements - V. B. Bhandari, Tata McGraw-Hill Publishing Co. Ltd. 2. A text book of Machine Design - P. C. Sharma, D. K. Aggarwal, S. K. Kataria & Sons.
REFERENCE BOOKS	1. Machine Design, An integral approach - Robert L. Norton, Pearson Education Inc. 2. Design of Machine Elements - M. F. Spott, T. E. Shoup, L. E. Hornberger, S. R. Jayram, C. V. Venkatesh, Pearson Education Inc. 3. Mechanical Engineering Design - J. E. Shigley, C. R. Mischke, McGraw-Hill Publishing Co. Ltd., 4. Design Data (PSG College of Engg. & Tech.), DVP Printers
Journals & Periodicals:	**NIL**
Other Electronic Resources:	**NIL**

Evaluation Scheme	**Total Marks 100 marks**
Mid semester Marks	30 marks
End Semester Marks	50 marks

Continuous Evaluation Marks (20 Marks)	**CATEGORY**	**MARKS**
	Attendance	5 MARKS
	Quiz	5 MARKS
	Skill enhancement activities / case study	5 MARKS

	Presentation/ miscellaneous activities	5 MARKS
Course Outcomes	1. Learn to Identify the national and international standards pertaining to machine drawing.	
	2. Learn to Apply limits and tolerances to assemblies and choose appropriate fits	
	3. Learn to do Basic designing procedure	
	4. Understand how to Design under static loading conditions	
	5. Understand how to Design of riveted joint, welded joints, power screws, shafts, keys and couplings, pressure vessels etc.	

BTFS406	**Fluid Mechanics & Pumping machinery**	**L**	**T**	**P**	**C**
		3	**0**	**2**	**4**
Total Credits: 4	**Total Hours in semester : 45 hrs +30hrs**		**Total Marks:100**		

1	**Course Pre-requisites: Engineering Mechanics**
2	**Course Category: Other Department Core Courses**
3	**Course Revision/ Approval Date:23rd June 2020**
4. **Course Objectives :**	
1	To introduce to the principles of hydraulic machinery
2	To introduce to centrifugal pumps

3	To introduce to nozzles & hoses
4	To introduce Bernoulli theorem & flow measurement devices
5	To introduce to dimensional analysis

Course Content	Weightage	Contact hours	Pedagogy
Unit 1:Theory:DIMENSIONAL ANALYSIS: Dimensions and units; Dimensional homogeneity; Buckingham's pie theorem, Laws of Similarity. FLOW IN PIPES: Friction losses in pipes; loses due to sudden enlargement and contraction, Hydraulic and energy gradient lines, siphon, pipes in series and parallel, branching of pipes. Water hammer problems. Practicals: 1.To determine the minor head loss coefficient for different pipe fittings. 2.To study the variation of friction factor f. For turbulent flow in rough and smooth commercial pipes. 3.To obtain the Reynolds number in different flow conditions.	20%	7 hours +6 hrs	Presentation, Video presentation, Chalk board, Notes
Unit 2:Theory: HYDRAULICS: The flow of water through open channels, pipe hose and nozzles. Measures of flow, pressure and pressure drop. Kinematics of fluids flow: Type of flow, path lines and stream lines, equation of continuity, one dimensional method of flow analysis. Practicals: 1. To determine the minor head loss coefficient for different pipe fittings. 2. To study the variation of friction factor f. For turbulent flow in rough and smooth commercial pipes	20%	8hours+4 hrs	Presentation, Video presentation, Chalk board Notes

Unit 3**: Theory** : DYNAMICS OF FLUID FLOW Energies-potential, pressure and kinetic, Momentum and energy equations for steady flow, bernoulli's theorem and its applications. FLUID MEASUREMENT: Pressure measurements, use of piezometers and static tubes, velocity measurements, use of pitch-tubes, current meters. Discharge measurement, use of venturimeter, Orifice meter etc. Practicals: 1.To study the Bernoulli theorem 2. To calibrate Venturimeter and to study the variation of coefficient of discharge with the Reynolds number. 3. To calibrate an rotameter and to study the variation of coefficient of discharge with the Reynolds number **4.**To determine the coefficient of discharge Cd, velocity Cv, and contraction Cc of various types of orifices.	20%	10hours+6 hrs	Presentation, Video presentation,Chalk board,Notes
Unit 4: Theory :Principles of Hydraulic Machinery, Dynamic Section of Fluid, Dynamic force and torque executed by fluid jet on plain, curved stationary and moving vanes; Velocity Diagrams, work done by impact, pressure due to deviated flow. Pumps (Positive Displacement Pumps) Reciprocating pumps; Basic theory, types, construction, installation characteristics and operation and accessories. Practicals : 1. Performance on hydraulic pumps: a) Single stage and multi stage centrifugal pumps 2. Performance on hydraulic pumps: a) Reciprocating pump. 3. Demonstration of cut section models of hydraulic turbines and pumps.	20%	10 hours+8hrs	Presentation, Video presentation,Chalk board,Notes

Unit 5: Theory:. Centrifugal pumps and its characteristics. Other water lifting devices, Ejector pumps, Air-lift pump installation operation. Parallel–Series, Centrifugal pumps. Pump Section, Maintenance and application. Fire water pump house in industry, Pumps running sequence, Pressure criteria. Practicals: 4. To study various characteristic curves of centrifugal pump **5.** To study the head- capacity- efficiency of parallel series centrifugal pump	20%	10 hours+6hrs	Presentation, Video presentation,Chalk board,Notes

LEARNING RESOURCES

TEXTBOOKS	• Fluid Mechanics" by Streeter V L and Wylie E B, • "Fluid Mechanics and Hydraulic Machines" by Rajput R K, • "Engineering Fluid Mechanics" by Kumar K L.
REFERENCE BOOKS	• Fluid Mechanics, Y. Cengel and J. Cimbala, McGraw Hill Education (India) Pvt. Ltd, New Delhi, 2010.
Journals & Periodicals:	**NIL**
Other Electronic Resources:	**NIL**

Evaluation Scheme	**Total Marks 100 marks**
Mid semester Marks	30 marks
End Semester Marks	50 marks

Continuous Evaluation Marks (20 Marks)	**CATEGORY**	**MARKS**
	Attendance	5 MARKS
	Quiz	5 MARKS
	Skill enhancement activities / case study	5 MARKS

	Presentation/ miscellaneous activities	5 MARKS
Course Outcomes	1. Understand the properties of fluids, and be able to solve the fluid flow problems.	
	2. Understand the mathematical techniques of practical flow problems.	
	3. Understand commonly used hydraulic machines and the energy exchange processes involved.	

Fifth Semester

SEMESTER 5													
Sr No	Course Code	Course Name	TEACHING SCHEME					EXAM SCHEME					
								THEORY MARKS			PRACTICAL		
			L	T	P	C	Hrs/week	CE	MID SEM	END SEM	LAB WORK	LAB EXAM	TOTAL
1	BTFS501	Fire service operations	3	0	2	4	5	20	30	50	20	30	150
2	BTFS502	Safety management-2	3	0	0	3	3	20	30	50	-	-	100
3	BTFS503	Electrical technology & safety	3	1	0	4	4	20	30	50	-	-	100
4	BTFS504	Occupation health & first aid	3	0	2	4	4	20	30	50	20	30	150
5	BTFS505	Fire safety in refinery, petrochemical, fertilizer& chemical industry	3	0	0	3	3	20	30	50	-	-	100
6	BTFS506	Introduction to fire dynamics	3	0	2	4	5	20	30	50	20	30	150
TOTAL						**22**	**24**	**TOTAL MARKS**					**750**

MS - Mid Semester, ES - End Semester, CE - Continuous Evaluation, LW - Laboratory Work, LE - Laboratory Exam

BTFS501	FIRE SERVICE OPERATIONS	L	T	P	C
		3	0	2	4
Total Credits: 4	**Total Hours in semester : 45 hrs + 30 hrs**		**Total Marks:100**		

1	**Course Pre-requisites: rescue services & operations**
2	**Course Category: Core Courses**
3	**Course Revision/ Approval Date:**

4. **Course Objectives :**

1	To understand the role and organizational structure of Fire Services in the country.
2	To provide fundamental understanding of Fire Service operations in terms of communication, mobilization, equipment, planning and strategies applied for responding to incidents.
3	Appreciate the need for an Incident command system to handle incidents effectively and safely, and understand how it is practically applied at incidents.
4	Understanding of different fire phenomena experienced by fire fighters and common techniques employed at high-rise building fires.
5	To familiarize students with operational fire fighting and rescue tactics applied at common industrial incidents involving buildings, electrical systems, and industrial plants.

Course Content	Weightage	Contact hours	Pedagogy
Unit 1:Theory: Role, functions and organization of different Fire Services within the country, and associated legislation. Understand the role of central and state government, and individual organizations for Fire service planning and set-up. Capabilities and infrastructure of different Fire Services in the country.	20%	10 hours	Presentation, Video presentation, Chalk board, Notes

Unit 2:Theory: Fire Service response arrangement in terms of equipment, communication and strategies being currently applied. Familiarization with communication equipment, Control room operations and mobilizing practices, Vehicle tracking and monitoring systems and radio operations and communication. **Practical:** - Visit to Municipal and Industrial Fire Services	20%	10 hours	Presentation, Video presentation, Chalk board Notes
Unit 3**: Theory** : Importance of Incident Command System in managing incident response, controlling risk and improving effectiveness of response. Organization on the Incident ground, levels of command and roles of Fire service personnel at each level of command. Sectorization of incident and span of control concepts at incidents. Inter-agency liasion.	20%	10 hours	Presentation, Video presentation,Chalk board,Notes
Unit 4: Theory : Understanding fires in buildings and different fire phenomena experienced by fire fighters. Importance of ventilation and different ventilation techniques being employed at incidents, including factors to be considered. Responding to fires at high-rise buildings, malls, underground buildings and basements. **Practical**: Visit to Municipal Fire Service to understand organizational structure and operational set-up.	20%	8 hours	Presentation, Video presentation,Chalk board,Notes
Unit 5: Theory: Responding to fires involving industrial systems and facilities. Understanding of Generation, transmission and distribution of electricity facilities and types of fires commonly encountered in these facilities. Response required for fires in generating stations, transformers, electrical sub-stations, storage batteries/ UPS systems. Safeguards during firefighting and rescue operations involving electrical and other industrial facilities. **Practical:** Visit to Industrial Fire Service to understand organizational structure and operational set-up	20%	7 hours	Presentation, Video presentation,Chalk board,Notes

LEARNING RESOURCES

TEXTBOOKS	1. Fire Service Manual, Volume 1, Communications and Mobilising, HMSO Publications 2. Fire Service Manual, Volume 2, Fire Service Operations, Compartment Fires and Tactical Ventilation, HMSO Publications

	3. Fire Service Manual, Volume 2, Fire Service Operations, Electricity, HMSO Publications 4. Fire Service Manual, Volume 2, Operational, Fire fighting foam, HMSO Publications 5. Fire Service Manual, Volume 2, Fire Service Operations, Petrochemical Incidents, HMSO Publications 6. Fire Service Acts & Rules of different states
REFERENCE BOOKS	1. Barendra Mohan Sen, Fire protection and prevention the essential handbook, UBS publishers
Journals & Periodicals:	**NIL**
Other Electronic Resources:	**NIL**

Evaluation cheme	**Total Marks 100 marks**	
Mid semester Marks	30 marks	
End Semester Marks	50 marks	
Continuous Evaluation Marks (20 Marks)	**CATEGORY**	**MARKS**
	Attendance	5 MARKS
	Quiz	5 MARKS
	Skill enhancement activities / case study	5 MARKS
	Presentation/ miscellaneous activities	5 MARKS

Course Outcomes	1. Students will be able to describe the role and organizational structure of different Fire Services in the country.
	2. Students will gain understanding of Fire Service operations in terms of communication, mobilization, equipment, planning and strategies applied for responding to incidents.

	3. Students will be able to explain an Incident command system and its role in handlingmajor incidents effectively and safely.
	4. Students will become familiar with common rescue and fire fighting techniques applied at high-rise building fires.
	5. Students will understand fire fighting tactics applied at common industrial incidents involving buildings, electrical systems, and plants.

BTFS502	**SAFETY MANAGEMENT-II**	**L**	**T**	**P**	**C**
		3	**0**	**0**	**3**
Total Credits: 3	**Total Hours in semester : 45 hrs**		**Total Marks:100**		

1	**Course Pre-requisites:** Safety Management-I
2	**Course Category: Core Courses**
3	**Course Revision/ Approval Date:**
	4. **Course Objectives :**
1	To familiarize with different Accident Indices for Safety Performance monitoring.
2	Demonstrate knowledge and skills in the basic concepts and techniques of safety management.
3	To understand the application of different safety appraisal and control techniques in industry.
4	To understand the fundamentals of accident investigation and reporting with its relevance in accident prevention.
5	To become aware of the concept of total loss control concept and its components.

Course Content	Weightage	Contact hours	Pedagogy
Unit 1:Theory: Types of accidents & performance rates, Definitions : Accidents - Reportable, Non-Reportable, Fatal, Non-Fatal. Near miss and Loss time accidents. Disabling injury, Accidents reportable under the Factories Act, ESI Act and Electricity Act. Safety Performance Rates : Frequency Rate, Severity Rate, Incidence Rate, Frequency Severity Index, Safety Score, Worked examples.	20%	10 hours	Presentation, Video presentation, Chalk board, Notes
Unit 2:Theory: Types of Disablement: Temporary and Permanent Disablement, Partial and Total Disablement. Time Charges scheduled in Workmen's Compensation Act 1923, National and International Standards, Worked examples.	20%	10 hours	Presentation, Video presentation, Chalk board,Notes
Unit 3**: Theory** : Accident and Incident Investigation, Reporting & analysis. Investigation - Philosophy, purpose, process and types of investigations, Identifying key factors and the immediate and basic causes. Corrective Action, Agencies investigating accident, Accident investigation Form, Methods of writing of accident investigation report. Reporting - reporting to authorities in statutory forms, writing reports, essential elements, reporting within prescribed time limits, reporting of dangerous occurrences. Analysis - Standard classification of factors associated with accident, methods of collating and tabulating data, record keeping.	20%	10 hours	Presentation, Video presentation,Chalk board,Notes
Unit 4: Theory : Safety Appraisal & Control Techniques. Plant Safety Rules and Procedures, Safe operating procedures (SOP), Safety checklists, Safety work permits, Plant safety inspections, Safety sampling, Safety survey, Job safety analysis (JSA), Safety inventory system, Product safety, Safety tag system.	20%	7hours	Presentation, Video presentation,Chalk board,Notes
Unit 5: Theory: Total Loss Control & Prevention; concepts and application. Emphasis on safety procedures and practices, training and monitoring for reducing losses and improving safety. Loss control systems such as - Implementation of loss control policy, Assignment of duties and responsibilities, Review of claims data, Audits and inspections, Accident reporting and investigation, Communications development and review of emergency and contingency plan	20%	8 hours	Presentation, Video presentation,Chalk board,Notes
LEARNING RESOURCES			

TEXTBOOKS	1. K.U. Mistry, Handbook of Industrial Safety, SiddarthPrakashan, India 2. Manning Michael, So You are the Safety Director, 3rd Ed, Government Institutes Inc, 3. Ian Long, Simplicity in Safety Investigations: A Practitioner's Guide to Applying Safety Science 1st Edition 4. P.K. Singh, Accident & Incident Investigation: (with Training Guide & Report Writing) (HSE Book 1)
REFERENCE BOOKS	1. Heinrich H.W. Industrial Accident Prevention McGraw - Hill Company, New York, 1980. 2. Krishnan N.V. Safety Management in Industry Jaico Publishing House, Bombay, 1997. 3. Lees, F.P., Loss Prevention in Process Industries Butterworth publications, London, 2nd edition, 1990. 4. John Ridley, Safety at Work, Butterworth and Co., London, 1983. 5. Dan Petersen, Techniques of Safety Management, McGraw- Hill Company, Tokyo, 1981.
Journals & Periodicals:	**NIL**
Other Electronic Resources:	**NIL**

Evaluation scheme	**Total Marks 100 marks**	
Mid semester Marks	30 marks	
End Semester Marks	50 marks	
Continuous Evaluation Marks (20 Marks)	**CATEGORY**	**MARKS**
	Attendance	5 MARKS
	Quiz	5 MARKS
	Skill enhancement activities / case study	5 MARKS
	Presentation/ miscellaneous activities	5 MARKS
	1. Students will become familiar with different Accident Indices & systems applied for Safety Performance	

Course Outcomes	monitoring.
	2. Students will be able to demonstrate knowledge of Basic concepts and techniques of Safety Management.
	3. Students will understand the application of different safety appraisal and control techniques in industry.
	4. Students will become familiar with accident investigation techniques, reporting formats and accident data analysis.
	5. Students will be aware of the concept of total loss control applied in industries, and it components.

BTFS503	**ELECTRICAL TECHNOLOGY & SAFETY**	**L**	**T**	**P**	**C**
		3	**1**	**0**	**4**
Total Credits: 4	**Total Hours in semester : 60 hrs**		**Total Marks:100**		

1	**Course Pre-requisites:** Safety Management-I
2	**Course Category: Core Courses**
3	**Course Revision/ Approval Date:**
4. **Course Objectives :**	
1	To provide fundamental understanding of electricity and current electrical systems in the country.
2	To gain knowledge of electrical generation, transmission and distribution systems and associated hazards.
3	Become familiar with and understand the function of safety devices and equipment employed in electrical systems.
4	To understand concepts of static electricity and electrical equipment in hazardous atmospheres.

5	To get exposed to commonly applied codes and standards related to electrical safety

Course Content	Weightage	Contact hours	Pedagogy
Unit 1:Theory: Fundamentals of electricity and electrical systems - electrical units, concept of resistance and other electricity fundamentals, type of conductors, and insulators, construction of commonly used electrical cables and their properties. The phenomenon of short circuit and causative factors. Protective devices used in electrical circuits such as fuses, circuit breakers and their importance.	20%	10 hours	Presentation, Video presentation, Chalk board, Notes
Unit 2:Theory: Different types of power generating stations, important equipment, units and basic design. Transmission systems, primary and secondary distribution, transmission lines, primary and secondary sub-stations, high and low voltage systems. Safety and fire hazards associated with power generating and transmission and distribution systems and protective systems/ devices used.	20%	10 hours	Presentation, Video presentation, Chalk board Notes
Unit 3**: Theory** : Substation equipments, different types of transformers – their working principles and applications, associated faults and hazards, protection systems and devices. Different fire protection systems and equipment currently being employed for protection of transformers. Internal distribution systems (low and high voltage, single phase & Three-phase low voltage), protection devices and systems required.	20%	10 hours	Presentation, Video presentation,Chalk board,Notes
Unit 4: Theory : Understanding static electricity – mechanism of generation, hazards affecting different industries and processes, different methods and systems employed in industry for controlling static electricity generation and accumulation. The concept of hazardous are classification for areas likely to have hazardous atmospheres, and different electrical equipment employed in hazardous areas, their suitability, working principle and characteristics.	20%	8 hours	Presentation, Video presentation,Chalk board,Notes
Unit 5: Theory: Exposure to different Indian Standards related to electrical safety - IS 1646 – 1961 Code of Practice for Fire Safety of Buildings (General) Electrical installations, IS 3034 – 1961 Code of Practice for fire safety of industrial buildings Electrical Generating and distribution stations, IS 2206 (Part – I) – 1962, Specifications for flame-proof electric lighting fitting, IS 2148 – 1968 Specifications for Flame Proof Enclosures of Electrical apparatus.	20%	7 hours	Presentation, Video presentation,Chalk board,Notes

LEARNING RESOURCES	
TEXTBOOKS	1. Fire Service Manual, Volume 2, Fire Service Operations, Electricity, HMSO Publications 2. J. Maxwell Adams, Electrical Safety a Guide to the Causes and Prevention of Electrical Hazards, IEE Power series-19. 3. D.C. Winburn, Practical Electrical Safety, Marcal Dekker. 4. S.Rao, Saluja, Electrical Safety, Fire Safety Engineering and Safety Management, Khanna Publishers 5. Arthur E. Cote, Fire Protection Handbook, Volume 1, Section 9 & 11, NFPA, USA
REFERENCE BOOKS	1. H.S. Kalsi, Electronics Instrument, TMH. K. Sawhney, Instrumentation & Measurement, DhanpatRai& Co.
Journals & Periodicals:	**NIL**
Other Electronic Resources:	**NIL**

Evaluation scheme	**Total Marks 100 marks**	
Mid semester Marks	30 marks	
End Semester Marks	50 marks	
Continuous Evaluation Marks (20 Marks)	**CATEGORY**	**MARKS**
	Attendance	5 MARKS
	Quiz	5 MARKS
	Skill enhancement activities / case study	5 MARKS
	Presentation/ miscellaneous activities	5 MARKS
	1. Students will learn fundamentals of electricity and electrical systems, their basic function, working and	

Course Outcomes	associated hazards
	2. Students will be able to explain electrical generation, transmission and distribution systems currently being employed.
	3. Students will be able to explain hazards associated with electrical systems and different safety devices and systems used, their function and operation.
	4. Students will be able to describe hazards arising out of static electricity and use of electrical equipment in hazardous atmospheres, and preventive and mitigate practices and systems applied.
	5. Students will get exposed to important codes and code requirements related to electrical safety.

BTFS504	**OCCUPATIONAL HEALTH & FIRST AID**	**L**	**T**	**P**	**C**
		3	**0**	**2**	**4**
Total Credits: 4	**Total Hours in semester : 45 hrs + 30hrs**		**Total Marks:100**		
1	**Course Pre-requisites:** Safety Management-I				
2	**Course Category: Core Courses**				
3	**Course Revision/ Approval Date:**				
4. **Course Objectives :**					
1	Under review				
2	Under review				

3	To learn about the human body & its various systems with reference to first aid and paramedic treatment.
4	To learn about the study of human casualty and its diagnosis.
5	To gain theoretical and practical knowledge of dealing with common injuries and conditions experienced at incidents.

Course Content	**Weightage**	**Contact hours**	**Pedagogy**
Unit 1:Theory: Content related to Occupational Health – 1 yet to be suggested by expert	20%	10 hours	Presentation, Video presentation, Chalk board, Notes
Unit 2:Theory: Content related to Occupational Health – 2 yet to be suggested by expert	20%	18 hours	Presentation, Video presentation, Chalk board Notes
Unit 3**: Theory** : Study of the human body and its various systems: Skeleton system, Muscular systems, Digestive system, Respiratory system, Circulatory system, Central Nervous system, Excretory system etc. and their functions. Practical examination of its vital functions such as pulse, breathing, movements of the chest and abdomen, movements of various joints of the body with structural changes in the body parts to understand condition of casualty. Practical study of internal organs from the model of the human body including microscopic study of various body cells and organs **Practical:** Study of human body and systems using suitable techniques	20%	14 hours	Presentation, Video presentation,Chalk board,Notes
Unit 4: Theory : Study of a Human Casualty: Including history taking, making of a diagnosis based on symptoms as narrated by the casualty and signs as observed by the paramedic. Checking temperature pulse, respiration, blood pressure, swellings, and discoloration of the skin, wounds, deformities etc. /to confirm the diagnosis. Casualties	20%	10 hours	Presentation, Video presentation,Chalk board,Notes

with affected vital functions, such as casualties in unconscious state, asphyxia, shock including their causes symptoms, signs and specific aspects of examination of such casualties and maintenance of records during their observation and care at the place incident and during transportations up to hospital. Study of specific injuries to body parts controlling their functions with external and internal injuries of head chest and abdomen including causes and consequences of external and internal bleeding. **Practical**: Practicals for evaluation of casualty (medical/ paramedical expert)			
Unit 5: Theory: First Aid/Paramedical care of various types of Casualties and their injuries such as wounds, burns, injuries of bones and joints, disturbances in vital function including cardiopulmonary resuscitation, artificial respiration by manual and instrumental methods, bandages, splints, correction of shock, arrest of bleeding, treatment of hyperpyrexia, use of anti/shock fluids and their administration, Observation and maintenance of such causalities. Casualty handling including observation, maintenance of observation charts, treatment administered, temperature-pulse-respiration records, application of suction, appropriate positioning of casualties affected by head injuries, chest injuries, abdominal injuries, bleeding, shock, asphyxia etc **Practical:** Practicals related to first aid (first aid/ paramedical expert)	20%	8 hours	Presentation, Video presentation,Chalk board,Notes

LEARNING RESOURCES

TEXTBOOKS	1. L.G Gupta &AbhitabhGupta , First Aid, Jaypee Brothers. 2. Cantlie, James, First Aid to injured, 3. Angus Maciver, Illustrated First Aid in English 4. St John Ambulance Association First Aid Manual by Indian Red Cross Society. 5. Dr. Rajeev Sharma, First Aid Guide, Diamond Books

	6. Books related to Occupational health -1 7. Books related to Occupational health -2
REFERENCE BOOKS	• Yet to be suggested by expert
Journals & Periodicals:	**NIL**
Other Electronic Resources:	**NIL**

Evaluation Scheme	**Total Marks 100 marks**	
Mid semester Marks	30 marks	
End Semester Marks	50 marks	
Continuous Evaluation Marks (20 Marks)	**CATEGORY**	**MARKS**
	Attendance	5 MARKS
	Quiz	5 MARKS
	Skill enhancement activities / case study	5 MARKS
	Presentation/ miscellaneous activities	5 MARKS
Course Outcomes	1. Outcome related to Occupational health - 1	
	2. Outcome related to Occupational health - 2	
	3. Students will become familiar with the human body & its various systems with reference to first aid and paramedic treatment.	
	4. Students will gain knowledge of the study of human casualty and give proper diagnosis.	

	5. Students will gain practical knowledge of first aid/paramedic care for dealing with common injuries and conditions experienced at incidents.

BTFS505	FIRE SAFETY IN REFINERY, PETROCHEMICAL, FERTILIZER& CHEMICAL INDUSTRY	L	T	P	C
		3	0	0	3
Total Credits: 4	**Total Hours in semester : 60 hrs**		**Total Marks:100**		

1	**Course Pre-requisites:** Safety Management-I
2	**Course Category: Core Courses**
3	**Course Revision/ Approval Date:**

4. **Course Objectives :**

1	To become familiar with different industrial processes carried out in Refinery, Petrochemical Plants, Fertilizer & Chemical Industry
2	Understand the characteristics of raw materials and products used in above industries and their hazardous properties
3	To learn about the different safety and fire prevention measures provided in these industries.
4	To appreciate the importance of emergency planning for high hazard industries and become aware of important actions required for major incidents.
5	To become aware of statutory requirements pertaining to fire prevention and safety for the above industries.

Course Content	Weightage	Contact hours	Pedagogy
Unit 1:Theory: Overview of the oil & gas industry and operations, activities and processes associated with upstream, midstream and downstream sectors. Crude oil -			Presentation, Video presentation, Chalk board,

formation, properties & characteristics, vapour formation, flammability, flash point, self ignition temperature, Classification of crude oil & its derivatives, MSDS of crude oil, diesel , gasoline, kerosene, LPG, Natural Gas, Naphtha, etc	20%	10 hours	Notes
Unit 2:Theory: Refining Processes: - Primary Distillation, catalytic cracking, polymerization, reforming, steam cracking, sulphur recovery, Lubricating oil treating, calcined coke, steam cracking, Process units such as desalter, ADU, VDU, FCC, hydrocracker, catalytic reformer etc. Storage tanks & its types. Fire prevention and safety measures required for these processes.	20%	18 hours	Presentation, Video presentation, Chalk board Notes
Unit 3**: Theory** : Properties and characteristics of raw materials and products used in Fertilizer & Chemical industries. Different units and processes in these industries, their hazards and fire prevention and safety measures required. Safety in design and operation.	20%	14 hours	Presentation, Video presentation,Chalk board,Notes
Unit 4: Theory : Understand Fire protection & emergency planning for high hazard industries - potential fire hazards, precautionary measures in case of non-ignited releases, oil & gas leaks. Fire fighting facilities for refineries, petrochemical & fertilizer plants. Major fire risks, design criteria for selection of fire water network, fire fighting installations such as hydrant, mobile water monitors, Storage tanks protection – different systems currently being applied. Use of various media in petroleum & gas fires such as water, foam, DCP.	20%	10 hours	Presentation, Video presentation,Chalk board,Notes
Unit 5: Theory: Statutory provisions pertaining to refineries, petrochemical plants & gas terminals – setup and role of organizations such as Oil Industry Safety Directorate (OISD) & Petroleum & Natural Gas Regulatory Board (PNGRB). Look at important OISD standards with respect to safety and fire protection such as OISD-116, 117,118. Overview of new and advanced technologies being applied for safety.	20%	8 hours	Presentation, Video presentation,Chalk board,Notes

LEARNING RESOURCES

TEXTBOOKS	1. Dalvi, S., Fundamentals of Oil & Gas Industry for Beginners, Notion Press 2. Fire Service Manual, Volume 2, Fire Service Operations, Petrochemical Incidents, HMSO

	Publications 3. OISD Standards (116 - Fire Protection Facilities for Petroleum Refineries and Oil/Gas Processing Plants, 117 - Fire Protection Facilities for Petroleum Depots, Terminals, Pipeline Installations & Lube oil installations, 118 - Layouts for Oil and Gas Installation 4. Petroleum & Natural Gas Regulatory Board (PNGRB) regulations 5. Books related to Fertilizer Industry process and hazards 6. Books related to Chemical industry processes and hazards
REFERENCE BOOKS	To be suggested by expert
Journals & Periodicals:	**NIL**
Other Electronic Resources:	**NIL**

Evaluation Scheme	**Total Marks 100 marks**	
Mid semester Marks	30 marks	
End Semester Marks	50 marks	
Continuous Evaluation Marks (20 Marks)	**CATEGORY**	**MARKS**
	Attendance	5 MARKS
	Quiz	5 MARKS
	Skill enhancement activities / case study	5 MARKS
	Presentation/ miscellaneous activities	5 MARKS
	1. Students will be able to describe industrial processes associated with Refinery, Petrochemical Plants, Fertilizer & Chemical Industry	

Course Outcomes	2. Students will understand characteristics of raw materials and products used in above industries and their hazardous properties.
	3. Students will learn about the different safety and fire prevention measures provided in these industries.
	4. Students will become aware of emergency planning requirements for high hazard industries and important actions required for major incidents.
	5. Students will get exposed to statutory requirements pertaining to fire prevention and safety for the above industries.

BTFS506	**INTRODUCTION TO FIRE DYNAMICS**	**L**	**T**	**P**	**C**
		3	**0**	**2**	**4**
Total Credits: 4	**Total Hours in semester : 60 hrs**		**Total Marks:100**		

1	**Course Pre-requisites:** Engineering Physics, Engineering Chemistry
2	**Course Category: Core Courses**
3	**Course Revision/ Approval Date:**
4. **Course Objectives :**	
1	To provide students with quantitative understanding of fire ignition, growth and behaviour, in terms of chemical thermodynamics, kinetics, and heat and mass transfer principles.
2	To understand different ignition and combustion mechanisms, behaviour of solid, liquid and gaseous fuels involved in combustion
3	To understand the impact of fire on occupants and materials in scientific terms, and be able to assess the same.

4	To be able to carry out calculations with respect to fire growth, smoke generation and spread, and toxicity/visibility effects of smoke.

Course Content	**Weightage**	**Contact hours**	**Pedagogy**
Unit 1:Theory: Fundamentals of heat transfer mechanisms in fluids and solids, fundamentals of combustion including material and energy balances, chemical thermodynamics, kinetics, premixed and diffusive burning. Advanced topics in the theory of combustion, flame propagation, efficiency of combustion, and the physico-chemical properties of combustible material. **Practical:** To be suggested	20%	10 hours	Presentation, Video presentation, Chalk board, Notes
Unit 2:Theory: Steady state heat conduction with and without heat generation, thermal insulation, selection criteria, critical and optimum thickness determination, extended surfaces and unsteady state heat transfer. Thermochemistry, Conservation Equations, Combustion Chemistry, Adiabatic Flame Temperatures **Practical:** To be suggested	20%	18 hours	Presentation, Video presentation, Chalk board Notes
Unit 3**: Theory** : Ignition in solid, liquid and gaseous fuels, and fire spread. Fire Characteristics of gaseous combustibles, types for gaseous flames, fire characteristics of liquids combustible; category of liquid fire, burning rate of liquid pools, flame spread rate,fire Characteristics of solid combustible: gasification, ignition, charring & melting, spontaneous ignition. . **Practical:**Practicals related to liquid pool fires, mass loss of solid fuel fires.	20%	14 hours	Presentation, Video presentation,Chalk board,Notes
Unit 4: Theory : Heat of combustion of materials, heat release rate in fires, flashover phenomenon, plumes, flame height, smoke generation and effluents in smoke, alongwith assessment methods and calculations. Estimating effects of smoke on visibility and toxicity based on material properties and combustion environment. **Practical**: Practical related to Heat release rate, effluent generation (IIT Gn)	20%	10 hours	Presentation, Video presentation,Chalk board,Notes
Unit 5: Theory: Premix & diffusion flames, heat transfer from fires to surrounding materials and structure, conductive, convective and radiative heat transfer in fires, important properties of materials with respect to heat transfer during fires and calculations.	20%	8 hours	Presentation, Video presentation,Chalk board,Notes

Practical: to be suggested			

LEARNING RESOURCES

TEXTBOOKS	1. Donald Q. Kern; Process Heat Transfer; Tata McGraw Hill. 2. Alan J. Chapman; Heat Transfer; Collier McMillan. 3. Rao Y.V.C; Heat Transfer; PHI 4. Quintiere, J. G., Fundamentals of Fire Phenomena, John Wiley & Sons, Chichester, UK, 2006. 5. Drysdale D, An Introduction to Fire Dynamics, 3rd Edition, John Wiley & Sons
REFERENCE BOOKS	• iNenno, P.J. (Ed.), SFPE Handbbok of Fire Protection Engineering (4th Edition), NFPA, Quincy, MA, 2008,
Journals & Periodicals:	**NIL**
Other Electronic Resources:	**NIL**

Evaluation Scheme	**Total Marks 100 marks**	
Mid semester Marks	30 marks	
End Semester Marks	50 marks	
Continuous Evaluation Marks (20 Marks)	**CATEGORY**	**MARKS**
	Attendance	5 MARKS
	Quiz	5 MARKS
	Skill enhancement activities / case study	5 MARKS
	Presentation/ miscellaneous activities	5 MARKS

Course Outcomes	1. Students will be able to demonstrate a quantitative understanding of fire ignition and growth, using application of thermodynamics, kinetics, heat and mass transfer principles.
	2. Students will gain understanding of different ignition and combustion mechanisms, and thebehaviour of solid, liquid and gaseous fuels involved in combustion.
	3. Students will be able to explain the impact of fire on occupants and materials in scientific terms, and be able to assess the same.
	4. Students will be able to carry out simple calculations related to fire growth, heat and smoke generation, energy transfer during fires, and smoke visibility and toxicity effects.

Sixth Semester

SEMESTER 6													
Sr No	Course Code	Course Name	TEACHING SCHEME					EXAM SCHEME					
								THEORY MARKS			PRACTICAL		
			L	T	P	C	Hrs/week	CE	MID SEM	END SEM	LAB WORK	LAB EXAM	TOTAL
1	BTFS601	Safety engineering and its industrial applications	3	0	0	3	3	20	30	50	-	-	100
2	BTFS602	Fire fighting & safety codes and standards	3	0	0	3	3	20	30	50	-	-	100
3	BTFS - 603	Fire protection systems -1	3	0	2	4	5	20	30	50	20	30	150
4	BTFS604	Fire& Safety Hazards in special sectors (Aviation, Marine & Nuclear)	3	0	2	4	5	20	30	50	20	30	150
5	BTFS605	Professional Elective-1	3	0	0	3	3	20	30	50	-	-	100
6	OE-1	Open Elective	3	0	0	3	3	20	30	50	-	-	100
Total						**20**	**22**	**Total**					**700**

MS - Mid Semester, ES - End Semester, CE - Continuous Evaluation, LW - Laboratory Work, LE - Laboratory Exam

BTFS601	SAFETY ENGINEERING AND ITS INDUSTRIAL APPLICATIONS	L	T	P	C
		3	0	0	3
Total Credits: 3	**Total Hours in semester : 45 hrs**		**Total Marks:100**		

1	**Course Pre-requisites:** Safety Management-II
2	**Course Category: Core Courses**
3	**Course Revision/ Approval Date:**

4. **Course Objectives :**

1	To introduce students to different aspects of safety engineering.
2	To understand the theory and principles of accident causation, prevention and control measures in industries.
3	To gain knowledge of fire and other hazards in different industries, and control measures applied for controlling the same.
4	Understand occupational and health hazards in industries and systems for addressing the same.

Course Content	Weightage	Contact hours	Pedagogy
Unit 1:Theory: Theory and principles of accident causation, unsafe act and unsafe conditions, case studies, Accident- Investigation Procedure, Safety performance measurement; Safety policy, Safety in material	20%	10 hours	Presentation, Video presentation, Chalk board, Notes
Unit 2:Theory: Hazards & risk assessment techniques, job safety analysis, fault tree analysis, ergonomic concept, local exhaust ventilation, plant inspection procedure, safe working in confined space, work permit system.Good housekeeping and safety, personal protective equipment needs & limitations	20%	10hours	Presentation, Video presentation, Chalk board Notes

Unit 3**: Theory** : Control of industrial noise, lighting, heat & ventilation, safety officer-role, responsibilities, power & duties, safety in use of hoists, lifts, & lifting machines, safety in pressure plants, principles of machine guarding, types & selection of machine guards	20%	10hours	Presentation, Video presentation,Chalk board,Notes
Unit 4: Theory : Safety in industries involving hazardous processes, safety in industries involving highly flammable liquids & flammable compressed gases, safety in chemical works, application of safety in handling corrosive substances, safety audit in various types of factories, types of safety audit, its methodology and reporting.	20%	7 hours	Presentation, Video presentation,Chalk board,Notes
Unit 5: Theory: Hazards & their control in the manufacture of articles from refractory materials, hazards in solvent extraction plants & their control, safety in industries, manufacturing rayon by viscose process, hazards & their control in fertilizer industries, hazards & control in LPG bottling plant	20%	8 hours	Presentation, Video presentation,Chalk board,Notes

LEARNING RESOURCES

TEXTBOOKS	1. Spellman, Whiting, The Handbook of Safety Engineering, Principles and Applications 2. Ganguly, Changeria, Safety Engineering, Chetan Publication, 2016 3. Deshmukh L.N., Industrial Safety Management, McGraw Hill, 2017 4. Handbook of Industrial Safety by K.U. Mistry, SiddarthPrakashan, Gujarat
REFERENCE BOOKS	1. Brauer R.L. Safety & Health for Engineers, 3rd edition, Wiley 2. The Handbook of Safety Engineering, Principles and Applications by Frank R. Spellman And Nancy E. Whiting
Journals & Periodicals:	**NIL**
Other Electronic Resources:	**NIL**

Evaluation Scheme	**Total Marks 100 marks**
Mid semester Marks	30 marks

End Semester Marks	50 marks	
Continuous Evaluation Marks (20 Marks)	**CATEGORY**	**MARKS**
	Attendance	5 MARKS
	Quiz	5 MARKS
	Skill enhancement activities / case study	5 MARKS
	Presentation/ miscellaneous activities	5 MARKS
Course Outcomes	1. Students will become familiar with different aspects of safety engineering in industries.	
	2. Students will be able to explain the principles of accident causation, prevention and control measures in industries.	
	3. Students will understand fire and other significant hazards associated with different industries and the engineering control measures applied.	
	4. Students will be able to describe occupational hazards associated with the industries and common practices to address them.	

BTFS602	**FIRE FIGHTING & SAFETY CODES AND STANDARDS**	**L**	**T**	**P**	**C**
		3	**0**	**0**	**3**
Total Credits: 3	**Total Hours in semester :45 hrs**		**Total Marks:100**		
1	**Course Pre-requisites:** Legislation related to Safety, Health, Environment & Fire				
2	**Course Category: Core Courses**				

3	**Course Revision/ Approval Date:**

4. **Course Objectives :**	
1	To understand the scope, jurisdiction and application of standards and codes being practiced in the country with respect to Fire Safety and Fire Protection.
2	Become aware of the code and standard writing process and the stakeholders, bodies and government involvement in the same.
3	Familiarize students with standards/ codes of major equipment/ systems being currently applied for Fire fighting and fire safety applications.
4	To understand the need and scope of industry specific standards and their application.
5	Be aware of standard making and product certification bodies and their roles and responsibilities.

Course Content	**Weightage**	**Contact hours**	**Pedagogy**
Unit 1:Theory: Understanding of code and standard preparation process, code/ standard preparing bodies - their role, responsibilities and scope. The role and importance of codes and standards. Application and use of local building bye-laws, GDCR rules, GFPLSMA rules, NBC Part 4 guidelines	20%	10 hours	Presentation, Video presentation, Chalk board, Notes
Unit 2:Theory: Standards related to Rescue and Fire-fighting vehicles and appliances viz Trailer pump, Water Tender, Foam Tender, Emergency Tender, DCP Tender (IS:944, IS:950, IS:10460, IS:949, IS;10993, IS:951).	20%	10 hours	Presentation, Video presentation, Chalk board Notes
Unit 3: Theory : Standards related to Firefighting equipment and fittings i.e. Fire extinguishers, Firefighting fittings, Fire service accessories, Fire Hoses (IS:2190, IS:15683, IS:5290, IS:884, IS:904, IS:636).	20%	10 hours	Presentation, Video presentation,Chalk board,Notes
Unit 4: Theory : The need for industry specific standards such as OISD, standards being used in Oil industry and its jurisdiction (OISD 117, 118, 169, etc). The organization and role of bodies such as OISD and PNGRB.	20%	7 hours	Presentation, Video presentation,Chalk board,Notes

Unit 5: Theory: Inspection and certification function of national standards bodies such as BIS. The role of international standard making bodies and product certification bodies such as NFPA, UL, FM; their relevance and jurisdiction.	20%	8 hours	Presentation, Video presentation,Chalk board,Notes

LEARNING RESOURCES

TEXTBOOKS	1. NFPA Fire protection Handbook, Section 1, Vol. 1, 20th Edition. 2. NBC Part 4, 2016 edition 3. Various BIS standards 4. OISD Standards – 117, 118, 169
REFERENCE BOOKS	**NIL**
Journals & Periodicals:	**NIL**
Other Electronic Resources:	**NIL**

Evaluation cheme	**Total Marks 100 marks**	
Mid semester Marks	30 marks	
End Semester Marks	50 marks	
Continuous Evaluation Marks (20 Marks)	**CATEGORY**	**MARKS**
	Attendance	5 MARKS
	Quiz	5 MARKS
	Skill enhancement activities / case study	5 MARKS
	Presentation/ miscellaneous activities	5 MARKS
	1. Students will be able to explain the significance, scope and application of codes and standards related to Fire-fighting and Fire Safety, currently being applied in the country.	

Course Outcomes	2. Students will be able to describe the code and standard writing process and role of stakeholders, bodies and government in the same.
	3. Students will get familiarized with standards/codes of major equipment/ systems being currently applied for Fire fighting and fire safety applications.
	4. Students will appreciate the need of industry specific standards and their scope and application.
	5. Students will understand the role and responsibilities of national and international standard making and product certification bodies

BTFS - 603	**Fire protection systems -1**	**L**	**T**	**P**	**C**
		3	**0**	**2**	**4**
Total Credits: 4	**Total Hours in semester : 45 hrs +30 hrs**		**Total Marks:100**		

1	**Course Pre-requisites:** nil
2	**Course Category: Core Courses**
3	**Course Revision/ Approval Date:**
4. **Course Objectives :**	
1	To introduce students to the need, suitability and effectiveness of commonly installed water based fire protection systems.
2	To understand design principles related to water based fire protection systems and carry out basic design calculations for these systems.
3	Identify design standards/codes and use guidelines provided in these documents for proper design and installation.

4	Understand the importance of testing and maintenance in effective functioning of fire protection systems, and interpret code and industry requirements related to ITM.

Course Content	Weightage	Contact hours	Pedagogy
Unit 1:Theory: Importance of water as an extinguishing agent; its physical properties which make it suitable for fire protection, with simple calculations. Different categories and suitability of water based fire protection systems i.e. Fire water hydrant system, rising mains, sprinkler systems, high & medium velocity water spray systems, water mist systems and foam systems.	20%	10 hours	Presentation, Video presentation, Chalk board, Notes
Unit 2:Theory: Fire Hydrant systems - categorization as per applicable codes. Water Supply &Pumping arrangements: Assessing firewater requirements based on code and design guidelines (NBC Part 4, IS:13039, OISD standards). Types of firewater storage arrangements. Firewater Pumps, types and arrangements commonly applied in the industry. Wet riser arrangement, external fire hydrant system, ring main piping and layout, provision of isolation valves, hydrants, monitors, fire brigade inlets and other accessories based on hazard category and design codes and guidelines.	20%	10 hours	Presentation, Video presentation, Chalk board Notes
Unit 3: Theory : Types of Sprinklers system and their application and characteristics. Design guidelines for sprinkler systems including pumping systems, alarm valves and sprinkler types and rating. Medium and High velocity water spray systems, their suitability, design guidelines and installation requirements as per relevant design and installation codes. Use and function of deluge valves in HVWS & MVWS systems. Water mist systems - categories, application and limitations. Understanding on the functioning and effectiveness of water mist for specified fire hazards, methods of generating mist, system hardware, installation practices and current codes.	20%	10 hours	Presentation, Video presentation,Chalk board,Notes

Unit 4: Theory : The need and effectiveness of firefighting foams on Class B fires. Categorization of firefighting foams based on expansion ratio, their application and effectiveness based on hazards. Different type of foam concentrates and their suitability. Design guidelines for standard foam systems for different types of storage tanks as per OISD and NFPA standards, including basic calculations and system specifications. Other types of foam application, their uses and limitations.	20%	9hours	Presentation, Video presentation,Chalk board,Notes
Unit 5: Theory: Importance of inspection, testing and maintenance practices for water based fire protection systems, code requirements and current practices.	20%	6 hours	Presentation, Video presentation,Chalk board,Notes

LEARNING RESOURCES

TEXTBOOKS	1. Arthur E. Cote, Fire Protection Handbook, Volume 1, Section-15 & 16, NFPA, USA 2. Fire Service Manual, Volume 3, Fire Safety, Fire Protection of Buildings, HMSO Books 3. Relevant IS codes: IS:13039-Fire Hydrant System, IS:15105 – Sprinkler Systems, IS:15301 – Fire Pumps, IS:15325 – Water Spray Systems 4. Robert M Gagnon, Designer's Guide to Automatic Sprinkler Systems,
REFERENCE BOOKS	• NFPA codes - 11-Foam systems, 13-Sprinkler Systems, 14-Standpipe systems, 15-Water spray systems, 20-Fire Pumps, 22-Water Tanks for Fire Protection, 24-Private Fire Service Mains, 25-ITM of Water based Fire Protection systems
Journals & Periodicals:	**NIL**
Other Electronic Resources:	**NIL**

Evaluation cheme	**Total Marks 100 marks**
Mid semester Marks	30 marks

End Semester Marks	50 marks	
Continuous Evaluation Marks (20 Marks)	**CATEGORY**	**MARKS**
	Attendance	5 MARKS
	Quiz	5 MARKS
	Skill enhancement activities / case study	5 MARKS
	Presentation/ miscellaneous activities	5 MARKS
Course Outcomes	1. Students will be able to identify and describe different water based fire protection systems currently installed in industry and buildings, based on occupancy and/or specific hazards.	
	2. Students will be able to carry out fundamental design calculations for water based fire protection systems and prepare basic layouts and specifications for different systems	
	3. Students will be able to identify and use code requirements for different water based fire protection system.	
	4. Students will appreciate the importance of ITM in effective functioning of fire protection systems and be able to identify important ITM requirements for water based systems.	

BTFS604	**Fire and Safety Hazards inSpecial Sectors (Aviation, Marine & Nuclear)**	**L**	**T**	**P**	**C**
		3	**0**	**2**	**4**

Total Credits: 4	Total Hours in semester :45 hrs +30 hrs	Total Marks:100

1	**Course Pre-requisites: Fire Service Operations**
2	**Course Category: Core Courses**
3	**Course Revision/ Approval Date:**

4. **Course Objectives :**

1	To gain basic understanding of the functioning and processes involved in aviation, marine and nuclear industries, and the fire/safety hazards associated with these industries.
2	Understand the control measures and systems applied for controlling fire/safety hazards in these industries.
3	Understand specific emergency response actions, systems and associated equipment for incidents in these industries .

Course Content	Weightage	Contact hours	Pedagogy
Unit 1:Theory: Understand the legislation and regulatory framework associated with special hazard sectors such as aviation, marine, and nuclear sectors, and familiarization with related laws and statutes. **Practical:** yet to be approved	20%	10 hours	Presentation, Video presentation, Chalk board, Notes
Unit 2:Theory: Functioning of Aviation Industry. Hazards in Airport, Protection & Types of Hangers, Refuelling and Defiling in Air Cargo, Crash Fire Tender: Provision of Crash, Fire Tenders including Rapid Intervening appliances, Categorization of Air-Port, their extinguishing media and determination of the appliances for each category as per International Standard. **Practical:** yet to be approved	20%	18 hours	Presentation, Video presentation, Chalk board Notes
Unit 3: Theory : Construction features of Air Craft , Types of Engines, Basic Fire-Hazards in Aircraft, Nature of Air Crashes, Emergency Landings including belly leading; Access to Fire Service Personnel and Escape of trapped persons problems,	20%	14 hours	Presentation, Video presentation,Chalk

Rescue and Fires in Air Craft and methods of fire-fighting; Problems of fire-fighting. Problems in dealing with Air Craft carrying ammunition, bombs nuclear weapons, etc **Practical:** yet to be approved			board,Notes
Unit 4: Theory : The maritime environment, organizational role, vessel types, construction & systems of fire detection & suppression systems, Vessel plans, drawings & documents, cargo vessel hazards & safety. Incident strategies & tactics training & planning, vessel fire incidents, Marine incidents & Rescue operations. **Practical:** yet to be approved	20%	10 hours	Presentation, Video presentation,Chalk board,Notes
Unit 5: Theory: Radio Active Material – Basic Theory. Principles& Techniques of radiation dissymmetry. Techniques of area and air monitoring. Techniques of personnel radiation protection. Sources and characteristics of radioactive waste and their types and their method of disposal. Handling and prevention of radiation emergencies and Storage requirements of radioactive materials. Fire fighting and rescue operations in the presence of radiation hazard. Pre plan of Radiation Incident. Radiation Safety in Nuclear Power Stations. **Practical:** yet to be approved	20%	8 hours	Presentation, Video presentation,Chalk board,Notes

LEARNING RESOURCES

TEXTBOOKS	1. FireServiceManualVolume2 -AircraftIncidents, HMSO Publications 2. The Fire Hazards of Fuelling Aircraft in the Open by D.S.I.R., HMSO LondonI.C.A.O. Standard 3. FireServiceManualVolume2 - Marine Incidents, HMSO Publications 4. NFPA Fire protection Handbook, Section 9, Vol. 1, 20th Edition.
REFERENCE BOOKS	1. yet to be approved

Journals & Periodicals:	**NIL**
Other Electronic Resources:	**NIL**

Evaluation cheme	**Total Marks 100 marks**	
Mid semester Marks	30 marks	
End Semester Marks	50 marks	
Continuous Evaluation Marks (20 Marks)	**CATEGORY**	**MARKS**
	Attendance	5 MARKS
	Quiz	5 MARKS
	Skill enhancement activities / case study	5 MARKS
	Presentation/ miscellaneous activities	5 MARKS
Course Outcomes	1. Student will be able to explain the legislation and regulatory framework associated with high hazard sectors such as aviation, marine and nuclear industry.	
	2. Student will be able to describe hazards and protection features applied in aviation, marine and nuclear industries.	
	3. Student will gain familiarity with specific emergency response actions, equipment and systems employed in these industries	

Seventh Semester

SEMESTER 7													
Sr No	Course Code	Course Name	TEACHING SCHEME					EXAM SCHEME					
								THEORY MARKS			PRACTICAL		
			L	T	P	C	Hrs/week	CE	MID SEM	END SEM	LAB WORK	LAB EXAM	TOTAL
1	BTFS - 701	Fire protection systems -2	3	0	2	4	5	20	30	50	20	30	150
2	BTFS702	Chemical Safety covering various types of industries	3	0	0	3	3	20	30	50	-	-	100
3	BTFS703	Management & Entrepreneurship Development	4	0	0	4	4	20	30	50	-	-	100
4	BTFS704	Industrial Hygiene, Applied Ergonomics & Occupational Health	4	0	0	4	4	20	30	50	-	-	100
5	BTFS705	Professional Electives -2	3	0	0	3	3	20	30	50	-	-	100
Total						18	23	**Total**					550

MS - Mid Semester, ES - End Semester, CE - Continuous Evaluation, LW - Laboratory Work, LE - Laboratory Exam

BTFS - 701	Fire protection systems -2	L	T	P	C
		3	0	2	4
Total Credits: 4	**Total Hours in semester : 45hrs +30 hrs**		**Total Marks:100**		

1	**Course Pre-requisites:** Fire protection systems -1
2	**Course Category: Core Courses**
3	**Course Revision/ Approval Date:**

4. **Course Objectives :**

1	To understand the need for different non-water based fire protection systems, and their suitability based on hazards.
2	To recognize the importance and need of different fire & gas detection methods and identify system types and suitability
3	To understand design principles of non water based fire protection systems and fire detection systems and be able to carry out basic design calculations for these systems.
4	Identify design standards/codes for above systems and use guidelines provided in these documents for proper design and installation.
5	Appreciate the importance of inspection, testing and maintenance in effective functioning of fire protection and fire & gas detection systems, and interpret code and industry requirements related to ITM.

Course Content	Weightage	Contact hours	Pedagogy
Unit 1:Theory: Importance of non-water based extinguishing agents; appreciate limitations of water based extinguishing, different types of non-water based extinguishing agents, their characteristics and suitability for different fire hazards. Overview of different non-water based fire protectino systems being currently installed - CO2, Clean Agents, Dry Chemical Powder, Wet Chemical Systems.	20%	10 hours	Presentation, Video presentation, Chalk board, Notes
Unit 2:Theory: CO2 systems and Clean Agent systems - extinguishing agent characteristics and suitability to different hazards, extinguishing concentration and	20%	10hours	Presentation, Video presentation, Chalk board

limitations. Design guidelines and basic calculations for extinguishing agent quantity. System components and equipment, layout and installation guidelines, provided in design and installation codes. Inspection, testing and maintenance requirements related to these systems.			Notes
Unit 3: Theory : Dry chemical and Wet chemical systems - extinguishing agent characteristics and suitability to different hazards, extinguishing concentration and limitations. Design guidelines and basic calculations for extinguishing agent quantity. System components and equipment, layout and installation guidelines, provided in design and installation codes. Inspection, testing and maintenance requirements related to these systems.	20%	10 hours	Presentation, Video presentation,Chalk board,Notes
Unit 4: Theory : Understand the use of different products and effects of fires based on fuel type and its significance in fire detection. Different types of fire detectors, and their suitability to different hazards. Simple design calculations related to fire detection systems. Different types of fire detection systems and their components. Understanding Cause & Effect matrix and interfacing with other systems and equipment.	20%	7 hours	Presentation, Video presentation,Chalk board,Notes
Unit 5: Theory: Importance and need of gas detection systems used in the industry. Different types of gas detectors currently employed in the industry, their working principles and installation requirements. Different alarm devices and their suitability depending on environment and location. Design & installation codes for Fire & gas detection systems and ITM practices followed in the industry.	20%	8 hours	Presentation, Video presentation,Chalk board,Notes

LEARNING RESOURCES

TEXTBOOKS	1. Arthur E. Cote, Fire Protection Handbook, Volume 1, Section-17, NFPA, USA 2. Arthur E. Cote, Fire Protection Handbook, Volume 1, Section-14, NFPA, USA 3. NFPA codes - 12-CO_2 extinguishing systems, 72-Fire Alarm Systems, 2001-Clean agent extinguishing systems
REFERENCE BOOKS	1. Fire Service Manual, Volume 1, Fire Service Technology, Equipment & media, Fire fighting foam - Technical, HMSO Books

	2. Relevant IS codes: IS:2189 Selection, Installation and Maintenance of Automatic Fire Detection and Alarm System Code of Practice, IS:15528 – CO_2 Systems, IS:15493 – Gaseous Extinguishing Systems
Journals & Periodicals:	**NIL**
Other Electronic Resources:	**NIL**

Evaluation Scheme	**Total Marks 100 marks**	
Mid semester Marks	30 marks	
End Semester Marks	50 marks	
Continuous Evaluation Marks (20 Marks)	**CATEGORY**	**MARKS**
	Attendance	5 MARKS
	Quiz	5 MARKS
	Skill enhancement activities / case study	5 MARKS
	Presentation/ miscellaneous activities	5 MARKS
Course Outcomes	1. Students will appreciate the need for different non-water based fire protection systems and identify such systems based on occupancy and/or specific hazards.	
	2. Students will understand different fire and gas detection systems currently being employed, and their suitability based on type of fire hazards.	
	3. Students will appreciate design concepts related to above systems and carry out basic calculations.	
	4. Students will be able to identify and use code requirements for design and installation of different non-water based fire protection system and fire & gas detection systems.	

	5. Students will appreciate the importance of ITM in effective functioning of fire protection and fire detection systems and be able to identify important ITM requirements for water based systems.

BTFS702	**Chemical Safety covering various types of industries**	**L**	**T**	**P**	**C**
		3	**0**	**0**	**3**
Total Credits: 3	**Total Hours in semester : 45hrs**		**Total Marks:100**		
1	**Course Pre-requisites:** Safety Engineering and Its Industrial Application				
2	**Course Category: Core Courses**				
3	**Course Revision/ Approval Date:**				
4. **Course Objectives :**					
1	To learn about the nature of chemicals; their exposure and toxic response on human body organ				
2	To learn about different kind of explosion like dust explosion.				
3	To learn about chemical risk analysis				
4	To learn about hazards in various industries				
5	To learn about HAZOP,FTA & FMEA techniques.				
Course Content		**Weightage**	**Contact hours**	**Pedagogy**	

Unit 1:Theory: General Principle of Chemical exposure and toxic response: Chemical exposure and cancer, chemical exposure and hypersensitivity, toxic response of lungs, liver, kidney, skin chemical exposure and health risk assessment.	20%	10 hours	Presentation, Video presentation, Chalk board, Notes
Unit 2:Theory: Various chemical hazards and their prevention in various type of industries steel, chemical, textile, Pharmaceutical, Power plant etc..	20%	8 hours	Presentation, Video presentation, Chalk board,Notes
Unit 3: Theory : Chemical risk analysis: Flammability: - vapour pressure, limits of flammability, Flash points, auto-ignition temperature.Stability Experimental methods of determination, classifications of instability risk, quantative approach. Toxicity Evaluation parameter, level of toxic risk, problem posed by determination of toxicity risk level, Quantative estimation method	20%	10 hours	Presentation, Video presentation,Chalk board,Notes
Unit 4: Theory : Explosion Hazards: Gas and vapor cloud explosion & means of preventing and mitigating in the process industry, Explosion in clouds of liquid droplets in air (spray/mist explosions), Dust Explosion.	20%	10 hours	Presentation, Video presentation,Chalk board,Notes
Unit 5: Theory: Methodology for Hazard and Risk analysis: Hazards survey or inventories, hazards and operability studies (HAZOP), failure mode and effect analysis (FMEA), fault tree analysis (FTA), **Event tree analysis.**	20%	7 hours	Presentation, Video presentation,Chalk board,Notes

LEARNING RESOURCES

TEXTBOOKS	1. Handbook of Industrial Safety by K.U. Mistry, SiddarthPrakashan, 108, Western Plaza, Near BhulkaBhavan School, Adajan Road, Surat – 395 009. (Gujarat). 2. Gujarat Factory rules.

REFERENCE BOOKS	• "Explosion Hazards and Evaluation" by W E Baker, "Safety and Hazards Management in Chemical Industries" by Mamta Vyas
Journals & Periodicals:	**NIL**
Other Electronic Resources:	**NIL**

Evaluation cheme	**Total Marks 100 marks**
Mid semester Marks	30 marks
End Semester Marks	50 marks

Continuous Evaluation Marks (20 Marks)	**CATEGORY**	**MARKS**
	Attendance	5 MARKS
	Quiz	5 MARKS
	Skill enhancement activities / case study	5 MARKS
	Presentation/ miscellaneous activities	5 MARKS

Course Outcomes	
	1. Students will learn about the nature of chemicals; their exposure and toxic response on human body organs
	2. Students will learn about different kind of explosion like dust explosion.
	3. Students will learn about chemical risk analysis
	4. Students will learn about hazards in various industries
	5. Students will learn about HAZOP,FTA & FMEA techniques.

BTFS703	Management & Entrepreneurship Development	L	T	P	C
		4	0	0	4
Total Credits: 4	Total Hours in semester :60hrs		Total Marks:100		

1	**Course Pre-requisites:** NIL
2	**Course Category: Other department Core Courses**
3	**Course Revision/ Approval Date:**

4. **Course Objectives :**

1	The course introduces to the management and managerial ethics
2	The course introduces to planning & its importance to planning
3	The course introduces to the concept of staffing
4	The course understands the basics of entrepreneurship
5	Introduces to role of financial institutions – financial support to institutions

Course Content	Weightage	Contact hours	Pedagogy
Unit 1:Theory: Introduction: Management – definitions, types of managers - evolution of management thought - principles of management - functions of management - social responsibility of management - challenges of management - managerial ethics	20%	6 hours	Presentation, Video presentation, Chalk board, Notes
Unit 2:Theory: Planning: Nature, purpose and importance of planning - types of plans - steps in planning - planning premises and forecasting – process of decision making – decision-tree analysis – organization - principles of organization - formal and informal organization - types of organization structure - line and staff relations – delegation –	20%	9 hours	Presentation, Video presentation, Chalk board Notes

decentralization - span of control-customer based and matrix organizations, team based structures, virtual organizations, boundary less organizations			
Unit 3: Theory : Staffing: Concept, nature, importance – steps- concept of knowledge worker - directing – concept, nature, importance - controlling - concept, nature, importance -process of controlling - control techniques – leadership - concept, nature, importance - attributes of a leader, developing. Case Study - planning, decision making, leadership	20%	15 hours	Presentation, Video presentation,Chalk board,Notes
Unit 4: Theory : Entrepreneur: Who is an entrepreneur? - functions and classifications of entrepreneurs - characteristics of entrepreneur - nature and importance of entrepreneur - entrepreneur vs. professional manager - women entrepreneurs -concepts of MSME and its growth in India - entrepreneurship and environment - policies governing entrepreneurs - entrepreneurial development programmes - institutions for entrepreneurship development	20%	15 hours	Presentation, Video presentation,Chalk board,Notes
Unit 5: Theory: Financial Support to Entrepreneurs: Role of financial institutions - bank finance to entrepreneurs - role of development financial institutions - concept of project and classification of project – identification and project formulation - project report - project design - project appraisal - profitability appraisal - project planning- budget and planning process - life cycle of an entrepreneurial venture - requirements for successful patent grants - steps in obtaining a patent - registration of trademark - copyright and the concept of fair use - protection of intellectual property - live interactions with entrepreneurs.	20%	15 hours	Presentation, Video presentation,Chalk board,Notes

LEARNING RESOURCES

TEXTBOOKS	• Koontz & O'Donnel¸ Essentials of Management, Tata McGraw Hill, New Delhi
REFERENCE BOOKS	• Louis A Allen, Management and Organization, McGrawHill, New York • Peter F Drucker, The Practice of Management, McGraw Hill, New York • Peter F. Drucker, Innovation and Development, McGraw Hill, New York • Vasanta Desai, Dynamics of Entrepreneurial Development and Management, Himalaya Publishing House, Mumbai
Journals & Periodicals:	**NIL**
Other Electronic Resources:	**NIL**

Evaluation Scheme	**Total Marks 100 marks**	
Mid semester Marks	30 marks	
End Semester Marks	50 marks	
Continuous Evaluation Marks (20 Marks)	**CATEGORY**	**MARKS**
	Attendance	5 MARKS
	Quiz	5 MARKS
	Skill enhancement activities / case study	5 MARKS
	Presentation/ miscellaneous activities	5 MARKS
Course Outcomes	1. The course helps to understand concept of the management and managerial ethics	
	2. The course helps to understand planning & its importance to planning	
	3. The course helps to understand the concept of staffing	
	4. The course helps to understand the basics of entrepreneurship	
	5. The course helps to understand role of financial institutions	

BTFS704	Industrial Hygiene, Applied Ergonomics & Occupational Health	L	T	P	C
		4	0	0	4
Total Credits: 4	Total Hours in semester : 60hrs	Total Marks:100			

1	**Course Pre-requisites:** Occupational health & first aid
2	**Course Category: Core Courses**
3	**Course Revision/ Approval Date:**

4. **Course Objectives :**

1	Overview of the course and Industrial hygiene
2	Occupational Hazards - the physical hazards
3	Occupational Hazards – chemical & biological hazards
4	Ergonomics at workplaces
5	Occupational health organizations. -

Course Content	Weightage	Contact hours	Pedagogy
Unit 1:Theory: Overview of Course, Introduction & Overview of Industrial Hygiene/Safety, industrial process risk assessments, brief review of Human Anatomy and Physiology, Toxicology (inhalation, skin, eye hazards and associated health hazards)	20%	10 hours	Presentation, Video presentation, Chalk board, Notes
Unit 2:Theory: Occupation Hazards: Physical Hazards-Noise (Sound level meters, Noise dosimeter, noise survey, monitoring, control, Hearing Conservation Programme (HCP) - Dust Particulates(Dust Sampling ,Gravimetric samplers, Personal samplers- Silica, Asbestos dusts measurement and control)- Vibration (Vibration meter, measurement, control, Whole body vibration, Vibration induced White Fingers-VIWF or HAVS, High pressure injuries) Ventilation, Illumination (lighting and safety, lighting and work, sources and of artificial	20%	18 hours	Presentation, Video presentation, Chalk board Notes

lighting, principles of good lighting, designing lighting installation)- Electro Magnetic Radiation (EMR)- Ionizing-Alpha, Beta, Gamma Rays, Radiation injuries, Acute Radiation Syndrome, Localized Radiation injuries, Delayed effects of Radiation, Case study of Chernobyl Disaster- Non-ionizing Radiation-Microwaves, Visible lights, Infra-red, Ultraviolet ,LASERS– Thermal effects Heat/Cold stress, Heat Exhaustion, Cramp, Rash, Syncope, Hyperpyexia, Stroke, Cold Frost, Heat Indices-Dry Bulb-Wet Bulb temperature, Radiant heat, Globe Bulb Temperature, WBGT. Atmospheric Pressure Disorders, Barotrauma, Decompression Sickness (Caisson's Disease), Compression Sickness. Hazards due o Nano-technology-			
Unit 3: Theory : Occupation Hazards:Chemical Hazards, Biological Hazards, Mechanical Hazards at Workplaces, Monitoring techniques, Sampling of contaminants, Direct reading equipment, Portable chromatography, InfraRed spectro-photometry-Particulate sampling, Filter sampling, Analysis of particulates-Control of Hazards Substitutions, Engineering control, Administrative control, Behaviour control, integrated control, Personal protection- Chemical Hazards(Gases, Liquids, Solids- Irritant gases, toxic gases, asphyxiating gases, Accidents in Confined spaces, Sewages, CETPs. Acids, Alkalies, Solvents, pesticides, Reactive chemical-Chemical Process Safety, Storage, Transport, Handling of chemicals- Heavy metals, Particulate-Silica, Asbestos - Biological hazards-Bacterial, Viral, Fungi, Moulds- Exposure evaluation, Sampling techniques, Personal monitoring, Biological monitoring, Threshold Limit Values (TLV), STEL. Biological hazards (Bacterial, Viral, Fungi, Moulds,), Hospital Waste management. -	20%	14 hours	Presentation, Video presentation,Chalk board,Notes
Unit 4: Theory : Ergonomics at workplaces; Ergonomics- Human Factors in Engineering, Approach to Job Design, Use of Anthropometric data, Improvement of Work, Workplace design(Design control, Displays-Control relationship-, Avoidance of Static positions at work, Illumination at Workstations, Proper Design of Seating arrangements-Chairs, Setting up of Computer Work stations, (monitor positions, Screen control, In-put devices, Key Board), Task variations, Exercise while at work, Controlling Risk factors to reduce body injuries, Repetitive Strain Injuries, Musculo-skeletal injuries, Effects of vibration hand tools, Principles of lifting weights, Push-Pull, Estimating Work capacity. -	20%	10 hours	Presentation, Video presentation,Chalk board,Notes

Unit 5: Theory: Occupational Health organizations: Understanding National and International organizations involved in Occupational Health: DGFASLI, DGMS under the Ministry of Labour & Employment , NIOH, AIIHPH under the Ministry of Health & Family Welfare, NIOSH,ACGIH,OSHA,ILO,WHO,WTO etc. -	20%	8 hours	Presentation, Video presentation,Chalk board,Notes

LEARNING RESOURCES

TEXTBOOKS	• **As referred by concerned expert**
REFERENCE BOOKS	• **As referred by concerned expert**
Journals & Periodicals:	**NIL**
Other Electronic Resources:	**NIL**

Evaluation Scheme	**Total Marks 100 marks**
Mid semester Marks	30 marks
End Semester Marks	50 marks

Continuous Evaluation Marks (20 Marks)	**CATEGORY**	**MARKS**
	Attendance	5 MARKS
	Quiz	5 MARKS
	Skill enhancement activities / case study	5 MARKS
	Presentation/ miscellaneous activities	5 MARKS

Course Outcomes	• yet to be reviewed by expert
	• yet to be reviewed by expert
	• yet to be reviewed by expert
	• yet to be reviewed by expert
	• yet to be reviewed by expert

BTFS705 – Professional Electives

AS SUGGESTED & APPROVED BY MANAGEMENT

Eight Semester

SEMESTER 8													
Sr No	Course Code	Course Name	TEACHING SCHEME					EXAM SCHEME					
								THEORY MARKS			PRACTICAL		
			L	T	P	C	Hrs/week	CE	MID SEM	END SEM	LAB WORK	LAB EXAM	TOTAL
1	BTFS801	Structural Fire Behaviour and Passive Fire Protection	3	0	0	3	3	20	30	50	-	-	100
2	BTFS 802	Environmental Impact Assessment & Waste Management	4	0	0	4	4	20	30	50	-	-	100
TOTAL						**17**	**7**	**TOTAL**					**200**

MS - Mid Semester, ES - End Semester, CE - Continuous Evaluation, LW - Laboratory Work, LE - Laboratory Exam

BTFS801	Structural Fire Behaviour and Passive Fire Protection	L	T	P	C
		3	0	0	3
Total Credits: 3	**Total Hours in semester : 45 hrs**		**Total Marks:100**		

1	**Course Pre-requisites:** Building fire prevention & protection
2	**Course Category: Core Courses**
3	**Course Revision/ Approval Date:**

4. **Course Objectives :**

1	To understand the effect of fire on building elements and building structure, and its influence on building design and fire fighting strategy.
2	Gain detailed knowledge of fire behavior of important building materials such as concrete, steel, wood and masonry.
3	Understand the role and importance of compartmentation in building fire safety and application of different passive fire protection methods.

Course Content	Weightage	Contact hours	Pedagogy
Unit 1:Theory: Introduction to main elements of structure - load bearing and non-load bearing, their function and design principles. Behaviour of structural elements at elevated temperature, and effect on overall structure. Importance and contribution of structural fire resistance to overall fire safety and code requirements related to fire resistance of building structure (NBC part 4).	20%	10 hours	Presentation, Video presentation, Chalk board, Notes
Unit 2:Theory: Active versus passive fire protection. Understand concept of fire resistance, different time-temperature curves and criteria used for fire resistance testing. Concept of fire severity& factors affecting fire severity. Different methods applied for calculating fire severity (Lie, Eurocode, etc) and carry out simple calculations. Column/ beam behaviour at elevated temperature and calculation methods for assessing performance.	20%	10 hours	Presentation, Video presentation, Chalk board Notes

Unit 3: Theory : Behaviour of different construction materials under fire. Concrete spalling and related factors - methods for improvement. Loss of strength in steel with temperature and methods for protection of steel members. Masonry behaviour in fire and improvement. Behaviour of different woods under influence of fire; process of charring. Different methods used for improving fire resistance of steel and wood. Behaviour of other building materials; glass, polymers, cladding materials. Test methods applied for assessing fire performance of materials.	20%	10 hours	Presentation, Video presentation,Chalk board,Notes
Unit 4: Theory : Compartmentation and its importance in building fire and life safety. Code requirements for compartmentation based on occupancy i.e. separation of occupancies, maximum compartment sizes depending on occupancies, fire protection of exits, compartmentation of hazardous areas. Code guidelines for concrete/masonry wall dimensions for specific fire resistance. Requirements for doors/windows and other openings in compartments, and test methods for assessment of performance.	20%	8 hours	Presentation, Video presentation,Chalk board,Notes
Unit 5: Theory: The need for having openings in walls and compartments for various building services and systems, curtain wall cladding gaps and issues related to fire and life safety. Different Fire stop materials and systems used for curtain wall cladding, through wall penetrations, etc. Fire and Fire/Smoke dampers used in HVAC systems and their characteristics.	20%	7 hours	Presentation, Video presentation,Chalk board,Notes

LEARNING RESOURCES

TEXTBOOKS	1. Buchanan A.H, Structural Design for Fire Safety 2. Fire Service Manual, Volume 3 Fire Safety, Basic Principles of Building Construction, HMSO Books 3. NFPA Fire protection Handbook, Section 18 &1 9, Vol. 2, 20th Edition. 4. National Building code of India 2016, Part-4, BIS
REFERENCE BOOKS	**NIL**
Journals & Periodicals:	**NIL**
Other Electronic Resources:	**NIL**

Evaluation Scheme	**Total Marks 100 marks**	
Mid semester Marks	30 marks	
End Semester Marks	50 marks	
Continuous Evaluation Marks (20 Marks)	**CATEGORY**	**MARKS**
	Attendance	5 MARKS
	Quiz	5 MARKS
	Skill enhancement activities / case study	5 MARKS
	Presentation/ miscellaneous activities	5 MARKS
Course Outcomes	1. Student will be able to explain effects of fire on building materials, building elements and structure and apply current code requirements related to structural fire safety and compartmentation	
	2. Student will be able to carry out simple calculations related to fire severity, and behaviour of columns/beams at elevated temperature.	
	3. Student will understand fire and life safety issues associated with curtain wall cladding, through penetrations and become familiar with different fire-stopping materials and practices	

BTFS 802	Environmental Impact Assessment & Waste Management	L	T	P	C
		4	0	0	4
Total Credits: 4	Total Hours in semester : 60 hrs		Total Marks:100		

1	**Course Pre-requisites:** Legislations related to EHS & Fire
2	**Course Category: Core Courses**
3	**Course Revision/ Approval Date:**

4. **Course Objectives :**

1	**Yet to be reviewed by expert**
2	**Yet to be reviewed by expert**
3	**Yet to be reviewed by expert**
4	**Yet to be reviewed by expert**
5	**Yet to be reviewed by expert**

Course Content	Weightage	Contact hours	Pedagogy
Unit 1:Theory: Concepts – Methodologies – Screening- Scoping- Base line studies- Mitigation – Matrices - Check List. Legislative and Environmental Clearance procedures in IndiaPredication tools for EIA. Overview - Air – Water – Soil- Noise- Biological.	20%	15 hours	Presentation, Video presentation, Chalk board, Notes
Unit 2:Theory: Public participation- resettlement and rehabilitation. Documentation of EIA Environmental management Plan- Post Project monitoring- Environmental Audit- Life cycle Assessment – EMS – case studies in EIA.	20%	15 hours	Presentation, Video presentation, Chalk board Notes

Unit 3: Theory : Types and Sources of solid and hazardous wastes - Need for solid and hazardous waste management - Legislations on management and handling of municipal solid wastes, hazardous wastes, and biomedical wastes, Elements of integrated waste management. Waste generation rates – Composition - Hazardous Characteristics – TCLP tests – waste sampling- Source reduction of wastes – Recycling and reuse.	20%	8 hours	Presentation, Video presentation,Chalk board,Notes
Unit 4: Theory : Handling and segregation of wastes at source – storage and collection of municipal solid wastes – Analysis of Collection systems - Need for transfer and transport – Transfer stations - labeling and handling of hazardous wastes. Waste processing – processing technologies – biological and chemical conversion technologies – Composting - thermal conversion technologies - energy recovery – incineration – solidification and stabilization of hazardous wastes - treatment of biomedical wastes	20%	12 hours	Presentation, Video presentation,Chalk board,Notes
Unit 5: Theory: Disposal in landfills - site selection - design and operation of sanitary landfills- secure landfills and landfill bioreactors – leachate and landfill gas management – landfill closure and environmental monitoring – landfill remediation.	20%	10 hours	Presentation, Video presentation,Chalk board,Notes

LEARNING RESOURCES

TEXTBOOKS	1. Environmental Impact Assessment, Canter R.L., McGraw Hill International Edition. 2. Environmental Impact Analysis Handbook, John G. Rau and David C. Wooten (Ed), McGraw Hill Book Company. 3. Integrated Solid Waste Management, George Tchobanoglous, Hilary Theisen and Samuel A, Vigil, McGraw- Hill, New York, 1993.
REFERENCE BOOKS	• CPHEEO, Manual on Municipal Solid waste management, Central Public Health and Environmental Engineering Organization, Government of India, New Delhi, 2000. •

Journals & Periodicals:	**NIL**
Other Electronic Resources:	**NIL**

Evaluation Scheme	**Total Marks 100 marks**	
Mid semester Marks	30 marks	
End Semester Marks	50 marks	
Continuous Evaluation Marks (20 Marks)	**CATEGORY**	**MARKS**
	Attendance	5 MARKS
	Quiz	5 MARKS
	Skill enhancement activities / case study	5 MARKS
	Presentation/ miscellaneous activities	5 MARKS
Course Outcomes	• Knowledge about EIA tools & methodologies, auditing and documentation of EIA.	
	• Students will be able to know processing and handling of solid waste in better way.	
	• **Yet To be reviewed by expert**	
	• **Yet To be reviewed by expert**	
	• **Yet To be reviewed by expert**	