

Survey of self



**Maharashtra State Board of Technical Education, Mumbai**  
**Teaching and Examination Scheme for Post S.S.C. Diploma Courses**

**Program Name : Civil Engineering Groups**

**Program Code : CE/CR/ CS**

**With Effect From Academic Year: 2017 - 18**

**Duration of Program : 6 Semesters**

**Duration : 16 Weeks**

**Semester : Second**

**Scheme - I**

S. N.	Course Title	Course Abbreviation	Course Code	Teaching Scheme			Credit (L+T+P)	Examination Scheme													Grand Total	
				L	T	P		Theory						Practical								
								Exam Duration in Hrs.	ESE		PA		Total		ESE		PA		Total			
									Max Marks	Min Marks	Max Marks	Min Marks	Max Marks	Min Marks	Max Marks	Min Marks	Max Marks	Min Marks	Max Marks	Min Marks		
1	Applied Mathematics	AMS	22201	3	1	-	4	3	70	28	30*	00	100	40	--	--	--	--	--	--	100	
2	Applied Science	Physics	ASM	22202	2	-	4	8	90 Min	70*#	28	15*	00	100	40	25@	10	25	10	50	20	200
		Chemistry			2	-										15*	00	25@	10	25	10	
3	Applied Mechanics	AME	22203	3	1	2	6	3	70	28	30*	00	100	40	25@	10	25	10	50	20	150	
4	Construction Materials	CMA	22204	3	-	2	5	3	70	28	30*	00	100	40	25@	10	25	10	50	20	150	
5	Basic Surveying	BSU	22205	3	-	4	7	3	70	28	30*	00	100	40	50#	20	50	20	100	40	200	
6	Civil Engineering Workshop and Practice	CEW	22008	-	-	4	4	--	--	--	--	--	--	--	50#	20	50~	20	100	40	100	
7	Business Communication Using Computers	BCC	22009	-	-	2	2	--	--	--	--	--	--	--	35@^	14	15~	06	50	20	50	
<b>Total</b>				<b>16</b>	<b>2</b>	<b>18</b>	<b>36</b>	<b>--</b>	<b>350</b>	<b>--</b>	<b>150</b>	<b>--</b>	<b>500</b>	<b>--</b>	<b>235</b>	<b>--</b>	<b>215</b>	<b>--</b>	<b>450</b>	<b>--</b>	<b>950</b>	

Student Contact Hours Per Week: **36 Hrs.**

Medium of Instruction: **English**

**Theory and practical periods of 60 minutes each.**

Total Marks : **950**

Abbreviations: ESE- End Semester Exam, PA- Progressive Assessment, L - Lectures, T - Tutorial, P - Practical

@ Internal Assessment, # External Assessment, \*# On Line Examination, ^ Computer Based Assessment

\* Under the theory PA, Out of 30 marks, 10 marks are for micro-project assessment (5 marks each for Physics and Chemistry) to facilitate integration of COs and the remaining 20 marks is the average of 2 tests to be taken during the semester for the assessment of the cognitive domain LOs required for the attainment of the COs.

~ For the courses having ONLY Practical Examination, the PA marks Practical Part - with 60% weightage and Micro-Project Part with 40% weightage

- **It is mandatory for the candidate to appear for practical (ESE) of both the part of Applied Science (Physics & Chemistry). Candidate remaining absent in exam of any one part, will be considered as absent for the head ESE (PR) of Applied Science.**
- **If Candidate not securing minimum marks for passing in the "PA" part of practical of any course of any semester then the candidate shall be declared as "Detained" for that semester.**



**Program Name** : Civil Engineering Program Group  
**Program Code** : CE/CR/CS  
**Semester** : Second  
**Course Title** : Applied Mathematics  
**Course Code** : 22201

**1. RATIONALE**

This course is an extension of Basic Mathematics of first semester namely Applied Mathematics which is designed for its applications in engineering and technology using the techniques of calculus, differentiation, integration, differential equations and in particular numerical integration. Derivatives are useful to find slope of the curve, maxima and minima of the function, radius of curvature. Integral calculus helps in finding the area. Differential equation is used in finding the curve and its related applications for various engineering models. Numerical integration is used to find the area of the functions especially whose integration cannot be evaluated easily with routine methods. This course further develops the skills and understanding of mathematical concepts which underpin the investigative tools used in engineering.

**2. COMPETENCY**

The aim of this course is to help the student to attain the following industry identified competency through various teaching learning experiences:

- Solve civil engineering related broad-based problems using the principles of applied mathematics.

**3. COURSE OUTCOMES (COs)**

The theory, practical experiences and relevant soft skills associated with this course are to be taught and implemented, so that the student demonstrates the following *industry oriented* COs associated with the above mentioned competency:

- Calculate the equation of tangent, maxima, minima, radius of curvature by differentiation.
- Solve the given problems of integration using suitable methods.
- Apply the concept of integration to find area and volume.
- Solve the differential equation of first order and first degree using suitable methods.
- Apply the concept of numerical integration to investigate the area.

**4. TEACHING AND EXAMINATION SCHEME**

Teaching Scheme			Credit (L+T+P)	Examination Scheme												
L	T	P		Theory						Practical						
				Paper Hrs.	ESE Max	ESE Min	PA Max	PA Min	Total Max	Total Min	ESE Max	ESE Min	PA Max	PA Min	Total Max	Total Min
3	1	--	4	3	70	28	30*	00	100	40	--	--	--	--	--	--

(\*): Under the theory PA. Out of 30 marks, 10 marks are for micro-project assessment to facilitate integration of COs and the remaining 20 marks is the average of 2 tests to be taken during the semester for the assessment of the cognitive domain LOs required for the attainment of the COs.

**Legends:** L-Lecture; T – Tutorial/Teacher Guided Theory Practice; P -Practical; C – Credit, ESE -End Semester Examination; PA - Progressive Assessment

**5. COURSE MAP (with sample COs, Learning Outcomes i.e. LOs and topics)**

This course map illustrates an overview of the flow and linkages of the topics at various levels of outcomes (details in subsequent sections) to be attained by the student by the end of the course, in all domains of learning in terms of the industry/employer identified competency depicted at the centre of this map.

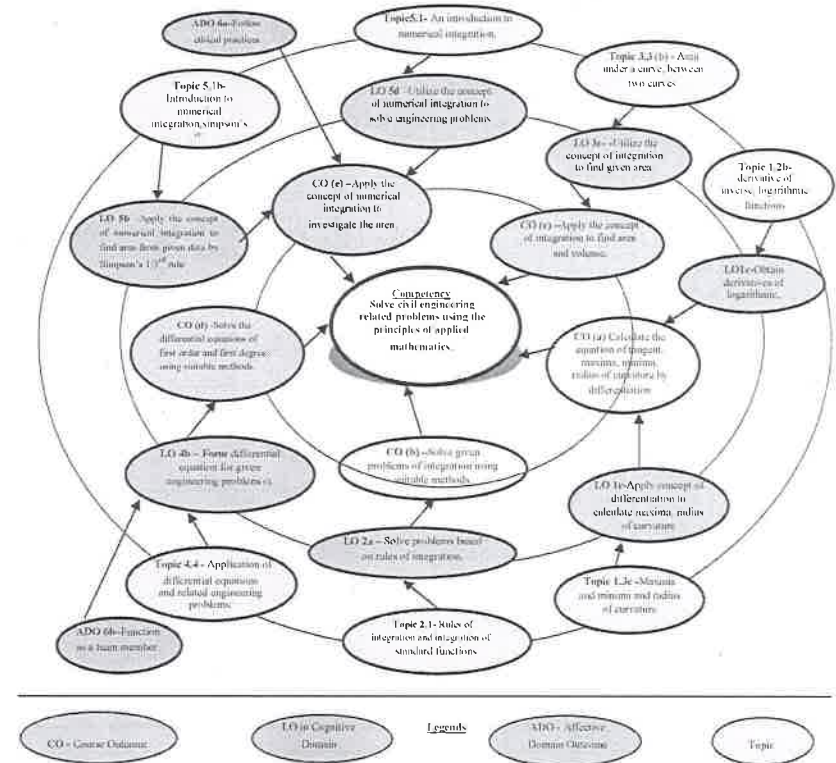


Figure 1 - Course Map

**6. SUGGESTED PRACTICALS/ EXERCISES**

The tutorials in this section are LOs (i.e.sub- components of the COs) to be developed and assessed in the student to lead to the attainment of the competency.



S. No.	Tutorials	Unit No.	Approx. Hrs. Required
1	Solve problems based on finding value of the function at different points.	I	1
2	Solve problems to find derivatives of implicit function and parametric function.	I	1
3	Solve problems to find derivative of logarithmic and exponential functions.	I	1
4	Solve problems based on finding equation of tangent and normal.	I	1
5	Solve problems based on finding maxima, minima of function and radius of curvature at a given point.	I	1
6	Solve the problems based on standard formulae of integration.	II	1
7	Solve problems based on methods of integration, substitution, partial fractions.	II	1
8	Solve problems based on integration by parts.	II	1
9	Solve practice problems based on properties of definite integration.	III	1
10	Solve practice problems based on finding area under curve, area between two curves and volume of revolutions.	III	1
11	Solve the problems based on formation, order and degree of differential equations.	IV	1
12	Develop a model using variable separable method to related engineering problem.	IV	1
13	Develop a model using the concept of linear differential equation to related engineering problem.	IV	1
14	Solve problems based on Trapezoidal rule	V	1
15	Solve problems based on Simpson's $1/3^{rd}$ rule and Simpson's $3/8^{th}$ rule.	V	1
16	Make use of concept of numerical integration to solve related civil engineering problems.	V	1
<b>Total</b>			<b>16</b>

*Note: The above tutorial sessions are for guideline only. The remaining tutorial hours are for revision and practice.*

**6. MAJOR EQUIPMENT/ INSTRUMENTS REQUIRED:**

- Not applicable -

**7. UNDERPINNING THEORY COMPONENTS**

The following topics/subtopics should be taught and assessed in order to develop LOs in cognitive domain for achieving the COs to attain the identified competency.

Unit	Major Cognitive Domain Learning Outcomes	Topics and Sub-topics
<b>Unit – I Differential Calculus</b>	1a. Solve the given simple problems based on functions. 1b. Solve the given simple problems based on rules of differentiation.	1.1 Functions and Limits : a) Concept of function and simple examples b) Concept of limits without

Unit	Major Cognitive Domain Learning Outcomes	Topics and Sub-topics
	1c. Obtain the derivatives of logarithmic, exponential functions. 1d. Apply the concept of differentiation to find given equation of tangent and normal 1e. Apply the concept of differentiation to calculate maxima and minima and radius of curvature for given function.	examples. 1.2 Derivatives : a) Rules of derivatives such as sum, product, quotient of functions. b) Derivative of composite functions (chain Rule), implicit and parametric functions. c) Derivatives of inverse, logarithmic and exponential functions. 1.3 Applications of derivative : a) Second order derivative without examples. b) Equation of tangent and normal c) Maxima and minima d) Radius of curvature
<b>Unit– II Integral Calculus</b>	2a. Solve the given simple problem(s) based on rules of integration. 2b. Obtain the given simple integral(s) using substitution method. 2c. Integrate given simple functions using the integration by parts. 2d. Evaluate the given simple integral by partial fractions.	2.1 Simple Integration: Rules of integration and integration of standard functions. 2.2 Methods of Integration: a) Integration by substitution. b) Integration by parts c) Integration by partial fractions.
<b>Unit– III Applications of Definite Integration</b>	3a. Solve given simple problems based on properties of definite integration. 3b. Apply the concept of definite integration to find the area under the given curve(s). 3c. Utilize the concept of definite integration to find area between given two curves. 3d. Invoke the concept of definite integration to find the volume of revolution of given surface.	3.1 Definite Integration: a) Simple examples b) Properties of definite integral (without proof) and simple examples. 3.2 Applications of integration : a) Area under the curve. b) Area between two curves. c) Volume of revolution.
<b>Unit-IV First Order First Degree Differential Equations</b>	4a. Find the order and degree of given differential equations. 4b. Form simple differential equations for given simple engineering problem(s). 4c. Solve given differential equations using the method of variable separable. 4d. Solve the given simple problems	4.1 Concept of differential equation 4.2 Order, degree and formation of differential equation. 4.3 Solution of differential equation a. Variable separable form. b. Linear differential equation. 4.4 Application of differential equations and related engineering problems.





Unit	Major Cognitive Domain Learning Outcomes	Topics and Sub-topics
	based on linear differential equations.	
<b>Unit –V Numerical Integration</b>	5a. Apply the concept of numerical integration to find area from given data by Trapezoidal rule. 5b. Apply the concept of numerical integration to find area from given data by Simpson's $1/3^{\text{rd}}$ rule. 5c. Apply the concept of numerical integration to find area from given data by Simpson's $3/8^{\text{th}}$ rule. 5d. Utilize the concept of numerical integration to solve related engineering problems.	5.1 An introduction to numerical integration. a. Trapezoidal rule. b. Simpson's $1/3^{\text{rd}}$ rule. c. Simpson's $3/8^{\text{th}}$ rule.

*Note: To attain the COs and competency, above listed Learning Outcomes (LOs) need to be undertaken to achieve the 'Application Level' of Bloom's 'Cognitive Domain Taxonomy'.*

#### 8. SUGGESTED SPECIFICATION TABLE FOR QUESTION PAPER DESIGN

Unit No.	Unit Title	Teaching Hours	Distribution of Theory Marks			
			R Level	U Level	A Level	Total Marks
I	Differential calculus	14	04	08	12	24
II	Integral calculus	12	02	06	08	16
III	Applications of Definite Integration.	08	02	02	04	08
IV	First Order First Degree Differential Equations	06	02	02	04	08
V	Numerical integration	08	02	05	07	14
<b>Total</b>		<b>48</b>	<b>12</b>	<b>23</b>	<b>35</b>	<b>70</b>

*Legends: R=Remember, U=Understand, A=Apply and above (Bloom's Revised taxonomy)*

*Note: This specification table provides general guidelines to assist student for their learning and to teachers to teach and assess students with respect to attainment of LOs. The actual distribution of marks at different taxonomy levels (of R, U and A) in the question paper may vary from above table.*

#### 9. SUGGESTED STUDENT ACTIVITIES

Other than the classroom and laboratory learning, following are the suggested student -related *co-curricular* activities which can be undertaken to accelerate the attainment of the various outcomes in this course:

- Identify engineering problems based on real world problems and solve with the use of free tutorials available on the internet.
- Use graphical software's: EXCEL, DPLLOT, and GRAPH for related topics.
- Use Mathcad as Mathematical Tools and solve the problems of Calculus.
- Identify problems based on applications of differential equations and solve these problems.

- Prepare models to explain different concepts of applied mathematics.
- Prepare a seminar on any relevant topic based on applications of integration.
- Prepare a seminar on any relevant topic based on applications of numerical integration to related engineering problems.

#### 10. SUGGESTED SPECIAL INSTRUCTIONAL STRATEGIES (if any)

These are sample strategies, which the teacher can use to accelerate the attainment of the various learning outcomes in this course:

- Massive open online courses (*MOOCs*) may be used to teach various topics/sub topics.
- '*L*' in item No. 4 does not mean only the traditional lecture method, but different types of teaching methods and media that are to be employed to develop the outcomes.
- About *15-20% of the topics/sub-topics* which is relatively simpler or descriptive in nature is to be given to the students for *self-directed learning* and assess the development of the LOs/COs through classroom presentations (see implementation guideline for details).
- With respect to item No.10, teachers need to ensure to create opportunities and provisions for *co-curricular activities*.
- Guide student(s) in undertaking micro-projects.

#### 11. SUGGESTED MICRO-PROJECTS

*Only one micro-project* is planned to be undertaken by a student assigned to him/her in the beginning of the semester. S/he ought to submit it by the end of the semester to develop the industry oriented COs. Each micro-project should encompass two or more COs which are in fact, an integration of practicals, cognitive domain and affective domain LOs. The micro-project could be industry application based, internet-based, workshop-based, laboratory-based or field-based. Each student will have to maintain dated work diary consisting of individual contribution in the project work and give a seminar presentation of it before submission. The total duration of the micro-project should not be less than *16 (sixteen) student engagement hours* during the course.

In the first four semesters, the micro-project could be group-based. However, in higher semesters, it should be individually undertaken to build up the skill and confidence in every student to become problem solver so that s/he contributes to the projects of the industry. A suggestive list is given here. Similar micro-projects could be added by the concerned faculty:

- Prepare models using the concept of tangent and normal to bending of roads in case of sliding of a vehicle.
- Prepare models using the concept of radius of curvature to bending of railway track.
- Prepare charts displaying the area of irregular shapes using the concept of integration.
- Prepare charts displaying volume of irregular shapes using concept of integration.
- Prepare models using the concept of differential equations for mixing problem.
- Prepare models using the concept of differential equations for radio carbon decay.
- Prepare models using the concept of differential equations for population growth.
- Prepare models using the concept of differential equations for thermal cooling.
- Prepare charts displaying the area of irregular shapes using the concept of Simpson's  $1/3^{\text{rd}}$  rule.
- Prepare charts displaying the area of irregular shapes using the concept of Simpson's  $3/8^{\text{th}}$  rule.



## 12. SUGGESTED LEARNING RESOURCES

S. No.	Title of Book	Author	Publication
1	Higher Engineering Mathematics	Grewal, B.S.	Khanna publications, New Delhi , 2013 ISBN- 8174091955
2	A Text Book of Engineering Mathematics	Dutta, D.	New Age International Publications, New Delhi, 2006, ISBN: 978-81-224-1689-3
3	Advanced Engineering Mathematics	Krezig, Ervin	Wiley Publications, New Delhi, 2016 ISBN:978-81-265-5423-2,
4	Advanced Engineering Mathematics	Das, H.K.	S. Chand Publications, New Delhi, 2008, ISBN: 9788121903455
5	Engineering Mathematics, Volume 1 (4 <sup>th</sup> edition)	Sastry, S.S.	PHI learning, New Delhi, 2014 ISBN-978-81-203-3616-2,
6	Comprehensive Basic Mathematics, Volume 2	Veena, G.R.	New Age International Publications, New Delhi, 2005 ISBN:978-81-224-1684-8
7	Getting Started with MATLAB-7	Pratap, Rudra	Oxford University Press, New Delhi, 2009 ISBN: 0199731241
8	Engineering Mathematics (3 <sup>rd</sup> edition)	Croft, Anthony.	Pearson Education, New Delhi,2010 ISBN: 978-81-317-2605-1

## 13. SOFTWARE/LEARNING WEBSITES

- a. [www.scilab.org/](http://www.scilab.org/) - SCI Lab
- b. [www.mathworks.com/products/matlab/](http://www.mathworks.com/products/matlab/) - MATLAB
- c. Spreadsheet applications
- d. [www.dplot.com/](http://www.dplot.com/) - DPlot
- e. [www.allmathcad.com/](http://www.allmathcad.com/) - MathCAD
- f. [www.wolfram.com/mathematica/](http://www.wolfram.com/mathematica/) - Mathematica
- g. <http://fossee.in/>
- h. <https://www.khanacademy.org/math?gclid=CNqHuabCys4CFdOJaAoddHoPig>
- i. [www.easycalculation.com](http://www.easycalculation.com)
- j. [www.math-magic.com](http://www.math-magic.com)



**Program Name** : Mechanical and Civil Engineering Program Group  
**Program Code** : AE/CE/FG/ME/PT/PG  
**Semester** : Second  
**Course Title** : Applied Science (Physics & Chemistry)  
**Course Code** : 22202

**1. RATIONALE**

Diploma engineers have to deal with various materials and machines. The study of concepts and principles of science like elasticity, viscosity, surface tension, motion, thermo couples, photo-sensors, LASERS, X-Rays, metals, alloys, cement, lime, refractory materials water treatment and analysis, fuel and combustion will help the student to select and use relevant materials and methods which will be economical and eco-friendly.

**2. COMPETENCY**

This aim of this course is to help the student to attain the following industry identified competency through various teaching learning experiences:

- Solve broad-based engineering problems using principles of advanced physics and chemistry.

**3. COURSE OUTCOMES (COs)**

The theory, practical experiences and relevant soft skills associated with this course are to be taught and implemented, so that the student demonstrates the following *industry oriented* COs associated with the above mentioned competency:

- Select relevant material in industry by analyzing its physical properties.
- Apply laws of motion in various applications.
- Use LASERS, X-Rays and photo electric sensors.
- Select the relevant metallurgical process related to industrial applications.
- Use relevant water treatment process to solve industrial problems.
- Use relevant fuel in relevant applications.

**4. TEACHING AND EXAMINATION SCHEME**

Teaching Scheme				Examination Scheme												
L	T	P	Credit (L+T+P)	Theory						Practical						
				ESE		PA		Total		ESE		PA		Total		
				Max	Min	Max	Min	Max	Min	Max	Min	Max	Min	Max	Min	
2	-	4	8	90	70*#	28	15*	00	100	40	25@	10	25	10	50	20
2	-			Min			15*	00			25@	10	25	10	50	20

(\*): Under the theory PA, Out of 30 marks, 10 marks are for micro-project assessment (5 marks each for Physics and Chemistry) to facilitate integration of COs and the remaining 20 marks is the average of 2 tests to be taken during the semester for the assessment of the cognitive domain UOs required for the attainment of the COs.

Legends: L-Lecture; T – Tutorial/Teacher Guided Theory Practice; P - Practical; C – Credit, ESE - End Semester Examination; PA - Progressive Assessment

Note: Practical of Chemistry and Physics will be conducted in alternate weeks for each batch.



**5. COURSE MAP with sample COs, PrOs, UOs, ADOs and topics**

This course map illustrates an overview of the flow and linkages of the topics at various levels of outcomes (details in subsequent sections) to be attained by the student by the end of the course, in all domains of learning in terms of the industry/employer identified competency depicted at the centre of this map.

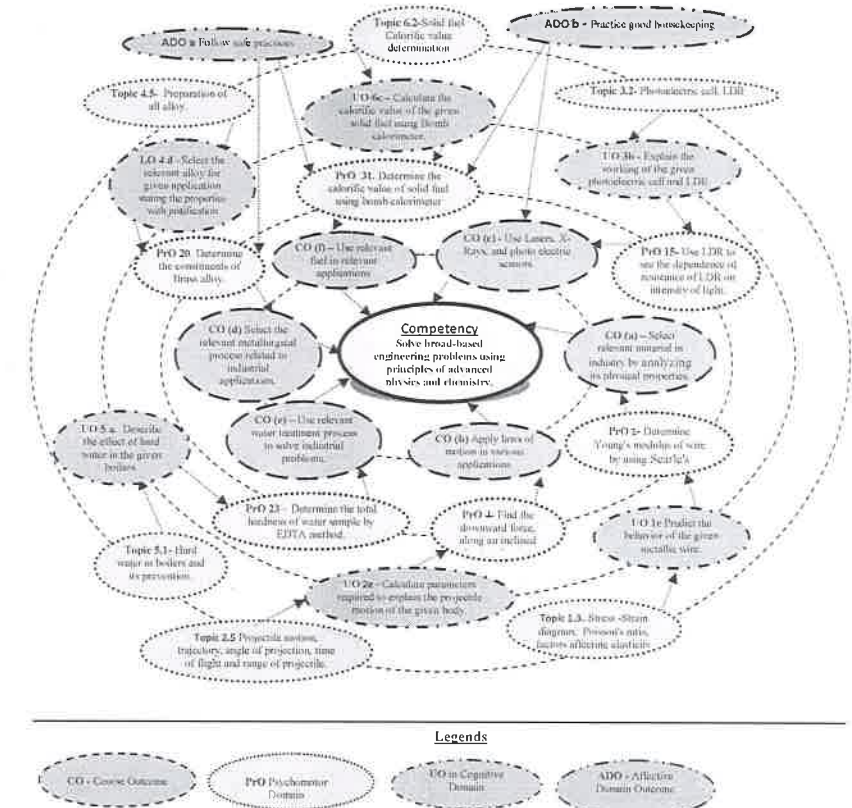


Figure 1 - Course Map

**6. SUGGESTED PRACTICALS/ EXERCISES**

The practicals in this section are PrOs (i.e. sub-components of the COs) to be developed and assessed in the student for the attainment of the competency.

S. No.	Practical Outcomes (PrOs)	Unit No.	Approx. Hrs. Required
<b>Physics</b>			
1	Use Searle's method to determine the Young's modulus of given	1	02*



S. No.	Practical Outcomes (PrOs)	Unit No.	Approx. Hrs. Required
	wire		
2	Apply Archimedes' principle to determine the buoyancy force on a solid immersed in liquid.	I	02
3	Determine the coefficient of viscosity of given liquid by Stoke's method.	I	02
4	Find the downward force, along an inclined plane, acting on a roller due to gravity and its relationship with the angle of inclination.	I	02
5	Predict the range of the projectile from the initial launch speed and angle.	II	02*
6	i) Find the dependence of the stopping potential on the frequency of light source in photo electric effect experiment. ii) Find the dependence of the stopping potential on the intensity of light source in photo electric effect experiment.	III	02
7	Determine the I-V characteristics of photoelectric cell and LDR.	III	02*
8	Determine the divergence of laser beam.	III	02
<b>Chemistry</b>			
9	Standardization of $\text{KMnO}_4$ solution using standard oxalic acid and Determine the percentage of iron present in given Hematite ore by $\text{KMnO}_4$ solution.	IV	02*
10	Determine the percentage of copper in given copper ore.	IV	02
11	Determine total hardness, temporary hardness and permanent hardness of water sample by EDTA method.	V	02*
12	Determine the alkalinity of given water sample.	V	02
13	Determine the turbidity of given water sample by Nephelometric method.	V	02
14	Determine the moisture and ash content in given coal sample using proximate analysis.	VI	02*
15	Determine the calorific value of given solid fuel using Bomb calorimeter.	VI	02*
16	Determine the percentage of Sulphur in given coal sample by ultimate analysis.(Gravimetric analysis)	VI	02
<b>Total</b>			<b>32</b>

**Note**

- i. A suggestive list of PrOs is given in the above table. More such PrOs can be added to attain the COs and competency. A judicious mix of minimum 12 or more practical need to be performed, out of which, the practicals marked as '\*' are compulsory, so that the student reaches the 'Precision Level' of Dave's 'Psychomotor Domain Taxonomy' as generally required by the industry.
- ii. The 'Process' and 'Product' related skills associated with each PrO is to be assessed according to a suggested sample given below:

S. No.	Performance Indicators	Weightage in %
1	Preparation of experimental set up	20
2	Setting and operation	20



S. No.	Performance Indicators	Weightage in %
3	Safety measures	10
4	Observations and Recording	10
5	Interpretation of result and Conclusion	20
6	Answer to sample questions	10
7	Submission of report in time	10
<b>Total</b>		<b>100</b>

The above PrOs also comprise of the following social skills/attitudes which are Affective Domain Outcomes (ADOs) that are best developed through the laboratory/field based experiences:

- Follow safe practices.
- Practice good housekeeping.
- Practice energy conservation.
- Demonstrate working as a leader/a team member.
- Follow ethical Practices.

The ADOs are not specific to any one PrO, but are embedded in many PrOs. Hence, the acquisition of the ADOs takes place gradually in the student when s/he undertakes a series of practical experiences over a period of time. Moreover, the level of achievement of the ADOs according to Krathwohl's 'Affective Domain Taxonomy' should gradually increase as planned below:

- 'Valuing Level' in 1<sup>st</sup> year
- 'Organising Level' in 2<sup>nd</sup> year
- 'Characterising Level' in 3<sup>rd</sup> year.

**7. MAJOR EQUIPMENT/ INSTRUMENTS REQUIRED**

The major equipment with broad specification mentioned here will usher in uniformity in conduct of experiments, as well as aid to procure equipment by administrators.

S. No.	Equipment Name with Broad Specifications	Exp. No.
1	Searle's apparatus (with slotted mass of 0.5 kg each)	1
2	Liquid container	2
3	Solid body (different size and materials)	3,4
4	Stoke's apparatus (glass tube, viscous liquid, spherical balls of varying sizes)	3
5	Stop watch	4,5
6	Photo transducer	4
7	Timer	4
8	Projectile motion detector	5
9	Photo electric effect apparatus	6
10	Experimental setup for characteristics of photoelectric cell	7
11	Experimental setup for characteristics of LDR	7
12	Laser Source (He Ne, diode laser)	8
13	Electronic balance, with the scale range of 0.001g to 500g pan size 100 mm; response time 3-5 sec; power requirement 90-250 V, 10 watt.	All
18	Electric oven inner size 18''x18''x18''; temperature range 100 to 250 <sup>o</sup> C with the capacity of 40 lt.	14,16
19	Bomb calorimeter	15

S. No.	Equipment Name with Broad Specifications	Exp. No.
20	Muffle furnace, Temperature up to 900 <sup>o</sup> C, digital temperature controller with an accuracy of +/- 3 <sup>o</sup> C	14, 16
21	Nephelometer ; Auto-ranging from 20-200 NTU, +/- 2% of reading plus 0.1 NTU, power 220 Volts +/- 10% AC 50 Hz	13

### 8. UNDERPINNING THEORY COMPONENTS

The following topics/subtopics should be taught and assessed in order to develop LOs in cognitive domain for achieving the COs to attain the identified competency.

Unit	Unit Outcomes (UOs) (in cognitive domain)	Topics and Sub-topics
<b>Physics</b>		
<b>Unit – I Properties of matter and Non-Destructive Testing</b>	1a. Explain concept of elasticity and plasticity for the given material.	1.1 Deforming Force and Restoring Force, Elasticity, Plasticity, Rigidity
	1b. Establish relation between given types of moduli of elasticity.	1.2 Stress and Strain and their types, Elastic limit and Hooke's law, types of moduli of elasticity
	1c. Predict the behavior of the given metallic wire.	1.3 Stress -Strain diagram, Poisson's ratio, factors affecting elasticity
	1d. Explain pressure-depth relation for the given law.	1.4 Fluid friction, pressure, pressure- depth relation, Pascal's law, Archimedes' principle
	1e. Explain Newton's law of viscosity for the given liquid.	1.5 Viscosity, velocity gradient, Newton's law of viscosity.
	1f. Explain Stokes' law for the free fall of the body through the given viscous medium.	1.6 Free fall of spherical body through viscous medium and Stokes' law, derivation of coefficient of viscosity 'η' by Stokes' method, effect of temperature and adulteration on viscosity of liquids.
	1g. Describe the salient features of the given NDT method.	1.7 Non-destructive testing (NDT), Various NDT methods used, Criteria for the selection of NDT method, merits and demerits of NDT
<b>Unit– II Types of Motion</b>	2a. Explain the equations of motion for the given body moving in the given type of path.	2.1 Displacement, velocity, acceleration and retardation, equations of motion, equations of motion under gravity.
	2b. Calculate the angular velocity of the given body.	2.2 Angular displacement, angular velocity, angular acceleration, three equations of angular motion
	2c. Explain the relevant Newton's laws of motion for the given moving object.	2.3 Momentum, impulse, impulsive force, Newton's laws of motion and their Applications
	2d. Calculate the work/power/energy for the given situation.	2.4 Work, power and energy: potential energy, kinetic energy, work -energy principle.
	2e. Calculate the given	

Unit	Unit Outcomes (UOs) (in cognitive domain)	Topics and Sub-topics
	parameters for the given projectile in motion.	2.5 Projectile motion, trajectory, angle of projection, time of flight and range of projectile with formulae.
<b>Unit– III Photoelectricity, X-Rays and LASERS</b>	3a. Explain the concept of the given parameters of the given material.	3.1 Planck's hypothesis, properties of photons, Photo electric effect: threshold frequency, threshold wavelength, stopping potential, Work function, characteristics of photoelectric effect, Einstein's photoelectric equation.
	3b. Explain the working of the given photoelectric device.	3.2 Photoelectric cell and LDR: principle, working and applications.
	3c. Explain the production of X-Rays of the given material with properties and applications.	3.3 Production of X-rays by modern Coolidge tube, properties and applications.
	3d. Differentiate between LASER and given colour of light	3.4 Laser: properties, absorption, spontaneous and stimulated emission, applications of Laser
3e. Explain the given terms with examples.	3.5 Population inversion, active medium, optical pumping, three energy level system, He-Ne Laser.	
<b>Chemistry</b>		
<b>Unit-IV Metals, alloys, Cement, and Refractory materials</b>	4a. Describe construction and working of the given type of furnace.	4.1 Metallurgy: Mineral, ore, gangue, flux, slag.
	4b. Describe the extraction process of the given ore with chemical reaction.	4.2 Types of furnace: Muffle furnace, Blast furnace.
	4c. Explain purposes and preparation methods of making the given alloy.	4.3 Extraction processes of Haematite, copper pyrite ores: Crushing, concentration, reduction, refining.
	4d. Select the relevant alloy for the given application stating the properties with justification.	4.4 Properties of iron and copper: Hardness, tensile strength, toughness, malleability, ductility, refractoriness, fatigue resistance, specific gravity, specific heat, brazing, castability, stiffness.
	4e. Describe the constituents, hardening and setting process of the given type of cement.	4.5 Preparation of alloys (Fusion and compression method).
	4f. Select the relevant refractory for given application stating the properties with justification.	4.6 Ferrous alloys: Low carbon, medium carbon, high carbon steels.
		4.7 Non-ferrous alloy: Brass, Bronze, Duralumin, Tinman Solder, Woods metal.
		4.8 Cement: Types; Biocement and Portland cement; constituents, setting and hardening, applications
		4.9 Lime: classification, constituents, setting and hardening, applications.





Unit	Unit Outcomes (UOs) (in cognitive domain)	Topics and Sub-topics
		4.10 Refractory material: Types, properties.
<b>Unit –V Water treatment</b>	5a. Describe the given terminologies related to hard water and their effects 5b. Describe the given process for softening of the given water sample. 5c. Describe with sketches the purification of the given type of water. 5d. Describe the given type of waste water treatment.	5.1 Hardness; Classification 5.2 Hard water in boilers and prevention; Boiler corrosion, caustic embrittlement, priming and foaming, scales and sludges. 5.3 Water softening: lime soda process (hot lime soda and cold lime soda process), zeolite process, ion exchange process (cation exchange and anion exchange). 5.4 Potable water treatment: Sedimentation, coagulation, filtration and sterilization. 5.5 Waste water treatment: sewage treatment, BOD and COD of sewage water; Reverse Osmosis, recycling of waste water.
<b>Unit-VI Fuels and Combustion</b>	6a. Describe salient properties of the given type of fuel. 6b. Explain the given type of analysis of the given type of coal. 6c. Calculate the calorific value of the given solid fuel using Bomb calorimeter. 6d. Describe composition, properties of given gaseous fuel with their applications. 6e. Calculate the mass and volume of air required for complete combustion of the given fuel.	6.1 Fuel: Calorific value and ignition temperature, classification. 6.2 Solid fuels: Coal, Classification and composition, proximate analysis, Ultimate analysis, Bomb calorimeter. Carbonization of coke by Otto Hofmann's oven. 6.3 Liquid fuels: Fractional distillation of crude petroleum, boiling range, composition, properties. Knocking, cracking, octane number and cetane number. 6.4 Gaseous fuels: Biogas, LPG, and CNG. Combustion equation of gaseous fuels, mass and volume of air required for complete combustion.

Note: To attain the COs and competency, above listed UOs need to be undertaken to achieve the 'Application Level' and above of Bloom's 'Cognitive Domain Taxonomy'.

#### 9. SUGGESTED SPECIFICATION TABLE FOR QUESTION PAPER DESIGN

Unit No.	Unit Title	Teaching Hours	Distribution of Theory Marks			
			R Level	U Level	A Level	Total Marks
<b>Physics</b>						
I	Properties of matter and NDT	14	03	05	06	14
II	Types of motion	09	02	02	06	10
III	Photoelectricity, X-Ray and LASER,	09	03	04	04	11
<b>Chemistry</b>						



Unit No.	Unit Title	Teaching Hours	Distribution of Theory Marks			
			R Level	U Level	A Level	Total Marks
IV	Metals, alloys, cement, refractory materials	12	02	04	06	12
V	Water treatment	10	02	03	06	11
VI	Fuels and combustion	10	03	04	05	12
<b>Total</b>		<b>64</b>	<b>15</b>	<b>22</b>	<b>33</b>	<b>70</b>

Legends: R=Remember, U=Understand, A=Apply and above (Bloom's Revised taxonomy)

Note: This specification table provides general guidelines to assist student for their learning and to teachers to teach and assess students with respect to attainment of UOs. The actual distribution of marks at different taxonomy levels (of R, U and A) in the question paper may vary from above table.

#### 10. SUGGESTED STUDENT ACTIVITIES

Other than the classroom and laboratory learning, following are the suggested student-related co-curricular activities which can be undertaken to accelerate the attainment of the various outcomes in this course:

- Seminar on any relevant topic.
- Library survey regarding engineering material used in different industries.
- Prepare power point presentation or animation for showing applications of lasers.

#### 11. SUGGESTED SPECIAL INSTRUCTIONAL STRATEGIES (if any)

These are sample strategies which the teacher can use to accelerate the attainment of the various learning outcomes in this course:

- Massive open online courses (MOOCs) may be used to teach various topics/sub-topics.
- 'L' in item No. 4 does not mean only the traditional lecture method, but different types of teaching methods and media that are to be employed to develop the outcomes.
- About 15-20% of the topics/sub-topics which is relatively simpler or descriptive in nature is to be given to the students for self-directed learning and assess the development of the COs through classroom presentations (see implementation guideline for details).
- With respect to item No.10, teachers need to ensure to create opportunities and provisions for co-curricular activities.
- Guide student(s) in undertaking micro-projects.

#### 12. SUGGESTED MICRO-PROJECTS

Only one micro-project is planned to be undertaken by a student assigned to him/her in the beginning of the semester. S/he ought to submit it by the end of the semester to develop the industry oriented COs. Each micro-project should encompass two or more COs which are in fact, an integration of COs, UOs and ADOs. The micro-project could be industry application based, internet-based, workshop-based, laboratory-based or field-based. Each student will have to maintain dated work diary consisting of individual contribution in the project work and give a seminar presentation of it before submission. The total duration of the micro-project should not be less than 16 (sixteen) student engagement hours during the course.

In the first four semesters, the micro-project could be group-based. However, in higher semesters, it should be individually undertaken to build up the skill and confidence in every

student to become problem solver so that s/he contributes to the projects of the industry. A suggestive list is given here. Similar micro-projects could be added by the concerned faculty:

- a. **Elasticity:** Prepare working model to demonstrate the stress – strain behavior of different wires of different thickness and material.
- b. **Viscosity:** Collect 3 to 5 liquids and prepare a working model to differentiate liquids on the basis of viscosity and demonstrate their applications.
- c. **Motion:** Prepare model of ball rolling down on inclined plane to demonstrate the conservation of energy and motion of an object in inclined plane.
- d. **Photo Sensors:** Prepare simple photo sensor using LDR.
- e. **Properties of Laser:** Use Key chain laser to differentiate laser with ordinary light.
- f. **Water analysis:** Collect water samples from different water sources and find the characteristics like acidity, conductivity, dissolved solids, suspended particles.
- g. **Water treatment:** Collect 3 to 5 water samples to find the dosage of bleaching powder required for its sterilization.
- h. **Water analysis:** Prepare model to find the soap foaming capacity of bore water on addition of soda ash.
- i. **Fuels:** Prepare chart showing different types of liquid fuels showing their calorific values and uses.
- j. **Cement:** Collect different samples of cement and find their initial and final setting time.
- k. **Refractory materials:** Prepare chart showing properties of refractory materials.
- l. **Metal properties:** Prepare chart showing different industrial application of metal and relate it with required property or properties using internet.
- m. **Alloy steel:** Find the effect of alloying elements like Mn, Cr, Ni, W, V, Co on properties of steel. Prepare chart of showing percentage composition, properties and industrial applications of different types of steel based on above alloying elements using internet.

### 13. SUGGESTED LEARNING RESOURCES

S. No.	Title of Book	Author	Publication
1	Physics Textbook Part I and Part - Class XI	Narlikar, J. V.; Joshi, A. W.; Mathur, Anuradha; <i>et al</i>	National Council of Education Research and Training, New Delhi, 2010. ISBN : 8174505083
2	Physics Textbook Part I and part II - Class XII	Narlikar, J.V.; Joshi, A. W.; Ghatak A.K. <i>et al</i>	National Council of Education Research and Training, New Delhi, 2013. ISBN : 8174506314
3	Engineering Physics	Bhattacharya, D. K.; Tandon Poonam	Oxford Publishing, New Delhi, ISBN:0199452814
4	Principles of Engineering Physics -I	Md. Nazoor Khan and Simanchala Panigrahi	Cambridge university press; New Delhi, 2016 ISBN : 9781316635643
5	Engineering Physics	Palanisamy, P. K.	SCITECH Publications, Chennai, ISBN: 9788183711012
6	Principles of Physics	Walker, J.; Halliday, D; Resnick, R	Wiley Publications, New Delhi, 10 <sup>th</sup> edition ISBN: 9788126552566
7	Textbook of Engineering Physics	Avadhanulu, M. N.; Kshirsagar, P. G.	S. Chand and Co., New Delhi, 2015 ISBN: 9788121908177
8	Engineering Chemistry	Agarwal, Shikha	Cambridge university press ; New Delhi, 2015 ISBN : 9781107476417

S. No.	Title of Book	Author	Publication
9	Engineering Chemistry	Dara, S. S.; Umare S.S.	S.Chand and Co. Publication, New Delhi, 201, ISBN: 8121997658
10	Engineering Chemistry	Jain & Jain	Dhanpat Rai and sons; New Delhi, 2015. ISBN : 9352160002
11	Engineering Chemistry	Vairam, S.	Wiley India Pvt. Ltd, New Delhi, 2013, ISBN: 9788126543342
10	Chemistry for engineers	Agnihotri, Rajesh	Wiley India Pvt.Ltd, New Delhi, 2014, ISBN: 9788126550784

### 14. SOFTWARE/LEARNING WEBSITES

- a. <http://nptel.ac.in/course.php?disciplineId=115>
- b. <http://nptel.ac.in/course.php?disciplineId=104>
- c. <http://hperphysics.phy-astr.gsu.edu/hbase/hph.html>
- d. [www.physicsclassroom.com](http://www.physicsclassroom.com)
- e. [www.fearofphysics.com](http://www.fearofphysics.com)
- f. [www.sciencejoywagon.com/physicszone](http://www.sciencejoywagon.com/physicszone)
- g. [www.science.howstuffworks.com](http://www.science.howstuffworks.com)
- h. <https://phet.colorado.edu>
- i. [www.chemistryteaching.com](http://www.chemistryteaching.com)
- j. [www.visionlearning.com](http://www.visionlearning.com)
- k. [www.chem1.com](http://www.chem1.com)
- l. [www.onlinelibrary.wiley.com](http://www.onlinelibrary.wiley.com)
- m. [www.rsc.org](http://www.rsc.org)
- n. [www.chemcollective.org](http://www.chemcollective.org)
- o. [www.wqa.org](http://www.wqa.org)
- p. [www.em-ea.org](http://www.em-ea.org)







**Program Name** : Mechanical, Civil Chemical and Fabrication Technology and Erection Engineering Program Group  
**Program Code** : AE/CE/CH/FG/ME/PT/PG  
**Semester** : Second  
**Course Title** : Applied Mechanics  
**Course Code** : 22203

**1. RATIONALE**

In day-to-day working we come across different types of structures created for different purposes and functions. While designing the structures, analysis of forces and stresses is an important and prerequisite step. Correct analysis is possible only when one knows the types and effects of forces acting on the structures. This course provides the scope to understand fundamental concepts of laws of mechanics and their applications to different engineering problems. This course is designed to provide basic understanding about the different types of forces, moments and their effects on structural elements, which will analysing different structural systems.

**2. COMPETENCY**

The aim of this course is to help the student to attain the following industry identified competency through various teaching learning experiences:

- Use principles of applied mechanics to solve broad-based engineering related problems.

**3. COURSE OUTCOMES (COs)**

The theory, practical experiences and relevant soft skills associated with this course are to be taught and implemented, so that the student demonstrates the following *industry oriented* COs associated with the above mentioned competency:

- Identify the force systems for given conditions by applying the basics of mechanics.
- Select the relevant simple lifting machine(s) for given purposes.
- Determine unknown force(s) of different engineering systems.
- Check the stability of various force systems.
- Apply the principles of friction in various conditions for useful purposes.
- Find the centroid and centre of gravity of various components in engineering systems.

**4. TEACHING AND EXAMINATION SCHEME**

Teaching Scheme				Examination Scheme												
L	T	P	Credit (L+T+P)	Theory						Practical						
				Paper Hrs.	ESE		PA		Total		ESE	PA		Total		
					Max	Min	Max	Min	Max	Min		Max	Min	Max	Min	
3	1	2	6	3	70	28	30*	00	100	40	25@	10	25	10	50	20

(\*): Under the theory PA, Out of 30 marks, 10 marks are for micro-project assessment to facilitate integration of COs and the remaining 20 marks is the average of 2 tests to be taken during the semester for the assessment of the cognitive domain UOs required for the attainment of the COs.

**Legends:** L-Lecture; T – Tutorial/Teacher Guided Theory Practice; P - Practical; C – Credit, ESE - End Semester Examination; PA - Progressive Assessment.

**5. COURSE MAP (with sample COs, PrOs, UOs, ADOs and topics)**

This course map illustrates an overview of the flow and linkages of the topics at various levels of outcomes details in subsequent sections) to be attained by the student by the end of the course, in all domains of learning in terms of the industry/employer identified competency depicted at the centre of this map.

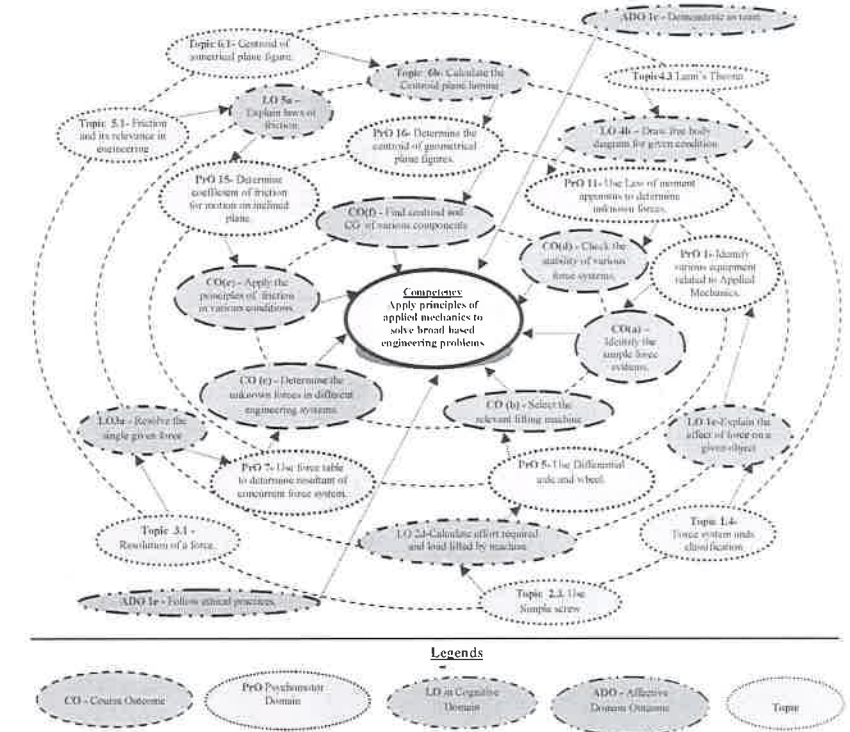


Figure 1 - Course Map

**6. SUGGESTED PRACTICALS/ EXERCISES**

The practicals in this section are PrOs (i.e. sub-components of the COs) to be developed and assessed in the student for the attainment of the competency.

S. No.	Practical Outcomes (PrOs)	Unit No.	Approx. Hrs. required
1	Identify various equipment related to Applied Mechanics.	I to VI	02
2	Use Differential axle and wheel.	II	02*



S. No.	Practical Outcomes (PrOs)	Unit No.	Approx. Hrs. required
3	Use Simple screw jack.	II	02
4	Use worm and worm wheel.	II	02
5	Use single or double purchase crab.	II	02
6	Use Weston's differential or wormed geared pulley block.	II	02
7	Use force table to determine resultant of concurrent force system applying Law of Polygon of forces. (Part-I)	III	02*
8	Use force table to determine resultant of concurrent force system applying Law of Polygon of forces. (Part-II)	III	02*
9	Graphically determine resultant of concurrent force system.	III	02
10	Graphically determine resultant of parallel force system.	III	02
11	Use Law of moment apparatus to determine unknown forces.	IV	02*
12	Apply Lami's theorem to determine unknown force.	IV	02
13	Determine support reactions for simply supported beam.	IV	02
14	Determine coefficient of friction for motion on horizontal plane.	V	02*
15	Determine coefficient of friction for motion on inclined plane.	V	02
16	Determine centroid of geometrical plane figures.	VI	02
	<b>Total</b>		<b>32</b>

**Note**

- i. A suggestive list of PrOs is given in the above table. More such PrOs can be added to attain the COs and competency. A judicious mix of minimum 12 or more practical need to be performed, out of which, the practicals marked as '\*' are compulsory, so that the student reaches the 'Precision Level' of Dave's 'Psychomotor Domain Taxonomy' as generally required by the industry.
- ii. The 'Process' and 'Product' related skills associated with each PrO is to be assessed according to a suggested sample given below:

S.No.	Performance Indicators	Weightage in %
1	Preparation of experimental set up	20
2	Setting and operation	20
3	Safety measures	10
4	Observations and Recording	10
5	Interpretation of result and Conclusion	20
6	Answer to sample questions	10
7	Submission of report in time	10
	<b>Total</b>	<b>100</b>

The above PrOs also comprise of the following social skills/attitudes which are Affective Domain Outcomes (ADOs) that are best developed through the laboratory/field based experiences:

- Follow safety practices.
- Practice good housekeeping.
- Demonstrate working as a leader/a team member.
- Maintain tools and equipment.
- Follow ethical practices.



The ADOs are not specific to any one PrO, but are embedded in many PrOs. Hence, the acquisition of the ADOs takes place gradually in the student when s/he undertakes a series of practical experiences over a period of time. Moreover, the level of achievement of the ADOs according to Krathwohl's 'Affective Domain Taxonomy' should gradually increase as planned below:

- 'Valuing Level' in 1<sup>st</sup> year.
- 'Organising Level' in 2<sup>nd</sup> year
- 'Characterising Level' in 3<sup>rd</sup> year.

**7. MAJOR EQUIPMENT/ INSTRUMENTS REQUIRED**

The major equipment with broad specification mentioned here will usher in uniformity in conduct of experiments, as well as aid to procure equipment by administrators.

S. No.	Equipment Name with Broad Specifications	Exp. No.
1	Differential axle and wheel (wall mounted unit with the wheel of 40 cm diameter and axles are in steps of 20 cm and 10 cm reducing diameter.	2
2	Simple screw Jack (Table mounted metallic body, screw with a pitch of 5 mm carrying a double flanged turn table of 20 cm diameter.	3
3	Worm and worm wheel (wall mounted unit with threaded spindle, load drum, effort wheel; with necessary slotted weights, hanger and thread)	4
4	Single Purchase Crab winch (Table mounted heavy cast iron body. The effort wheel is of C.I. material of 25 cm diameter mounted on a shaft of about 40mm dia. On the same shaft a geared wheel of 15 cm dia.	5
5	Double Purchase Crab winch (Having assembly same as above but with double set of gearing arrangement.)	5
6	Weston's Differential pulley block (consisting of two pulleys; one bigger and other smaller.	6
7	Weston's Differential worm geared pulley block (Consists of a metallic (preferably steel) cogged wheel of about 20 cm along with a protruded load drum of 10 cm dia to suspend the weights of 10 kg, 20 kg-2 weights and a 50 kg weights)	6
8	Universal Force Table (Consists of a circular 40 cm dia. Aluminum disc, graduated into 360 degrees.) with all accessories.	7, 10
9	Law of moments apparatus consisting of a stainless steel graduated beam 12.5 mm square in section, 1m long, pivoted at centre.	9
10	Beam Reaction apparatus (The apparatus is with two circular dial type 10 kg.	11
11	Friction apparatus for motion along horizontal and inclined plane (base to which a sector with graduated arc and vertical scale is provided. The plane may be clamped at any angle up to 45 degrees. pan. Two weight boxes (each of 5 gm, 10 gm, 2-20 gm, 2-50 gm, 2-100 gm weight).	12
12	Models of geometrical figures.	13

## 8. UNDERPINNING THEORY COMPONENTS

The following topics/subtopics should be taught and assessed in order to develop UOs in cognitive domain for achieving the COs to attain the identified competency.

Unit	Unit Outcomes (UOs) (in cognitive domain)	Topics and Sub-topics
<b>Unit – I Mechanics and force system</b>	1a. Explain concepts of the given terms. 1b. Use the relevant units of various quantities in the given situations. 1c. Explain effects of a force on the given object. 1d. Identify the force system for the given situation.	1.1. Significance and relevance: Mechanics, applied mechanics, statics, dynamics. 1.2. Space, time, mass, particle, body, rigid body. 1.3. Scalar and vector quantity, Units of measurement (SI units)- Fundamental units and derived units. 1.4. Force – unit, representation as a vector and by Bow's notation, characteristics and effects of a force, Principle of transmissibility of force, Force system and its classification.
<b>Unit – II Simple lifting machine</b>	2a. Describe the components of the given lifting machine. 2b. Differentiate the working principle of the given two types of simple lifting machines. 2c. Determine velocity ratio, efficiency and law of the given simple lifting machine. 2d. Calculate effort required and load lifted by the given simple lifting machine. 2e. Interpret the graphs after drawing them with the given data. 2f. Select the relevant simple lifting machine required for the given purpose with justification.	2.1 Simple lifting machine, load, effort, mechanical advantage, applications and advantages. Velocity ratio, efficiency of machines, law of machine. 2.2 Ideal machine, friction in machine, maximum Mechanical advantage and efficiency, reversible and non-reversible machines, condition for reversibility 2.3 Velocity ratios of Simple axle and wheel, Differential axle and wheel, Worm and worm wheel, Single purchase and double purchase crab winch, Simple screw jack, Weston's differential pulley block, geared pulley block. 2.4 Graphs of Load verses Effort, Load verses ideal Effort, Load verses Effort lost in friction, Load verses MA, Load verses Efficiency.
<b>Unit- III Resolution and compositio n</b>	3a. Resolve the given single force. 3b. Calculate the resultant of the given force system analytically. 3c. Determine graphically the resultant of the given force system. 3d. Find the resultant of the given force system using	3.1 Resolution of a force - Orthogonal and Non Orthogonal components of a force, moment of a force, Varignon's Theorem, 3.2 Composition of forces – Resultant, analytical method of determination of resultant for concurrent, non concurrent and parallel co-planar force systems – Law of triangle, parallelogram and polygon of forces. 3.3 Graphic statics, graphical representation

Unit	Unit Outcomes (UOs) (in cognitive domain)	Topics and Sub-topics
	law of triangle and law of parallelogram.	of force, Space diagram, force diagram, polar diagram and funicular polygon, Graphical method of determination of resultant for concurrent and parallel co-planar force systems.
<b>Unit– IV Equilibr ium</b>	4a. Draw the free body diagram for the given condition. 4b. Determine unknown force in the given situation using Lami's theorem. 4c. Identify the types of beams required for the given situation. 4d. Determine reactions in the given type of beam analytically and graphically.	4.1 Equilibrium and Equilibrant, Free body and Free body diagram, Analytical and graphical conditions of equilibrium, 4.2 Equilibrium of force systems analytically 4.3 Lami's Theorem. 4.4 Types of beam. supports (simple, hinged, roller and fixed) and loads acting on beam (vertical and inclined point load, UD load, couple), span of beam. 4.5 Beam reaction for cantilever, simply supported beam with or without overhang – subjected to combination of Point load and UD load or Vertical Point load and couple. 4.6 Beam reaction graphically for simply supported beam subjected to vertical loads only.
<b>Unit– V Friction</b>	5a. Determine force of friction and coefficient of friction for the given condition. 5b. Describe the conditions for friction for the give situation. 5c. Determine friction force in the given situation. 5d. Identify the various forces acting on a ladder for the given conditions using free body diagram.	5.1 Friction and its relevance in engineering, types and laws of friction, limiting equilibrium, limiting friction, co-efficient of friction, angle of friction, angle of repose, relation between co-efficient of friction and angle of friction. 5.2 Equilibrium of bodies on level surface subjected to force parallel and inclined to plane. 5.3 Equilibrium of bodies on inclined plane subjected to force parallel to the plane only. 5.4 FBD of ladder in friction
<b>Unit– VI Centroid and centre of gravity</b>	6a. Determine the centroid of geometrical plane figures and centre of gravity of the given simple solid. 6b. Calculate centroid of the given composite plane lamina 6c. Determine centre of gravity of the given solids. 6d. Determine centre of gravity of the given composite solid.	6.1 Centroid of geometrical plane figures (square, rectangle, triangle, circle, semi-circle, quarter circle) 6.2 Centroid of composite figures composed of not more than three geometrical figures 6.3 Centre of Gravity of simple solids (Cube, cuboid, cone, cylinder, sphere, hemisphere) 6.4 Centre of Gravity of composite solids composed of not more than two simple solids.





Note: To attain the COs and competency, above listed UOs need to be undertaken to achieve the 'Application Level' and above of Bloom's 'Cognitive Domain Taxonomy'.

#### 9. SUGGESTED SPECIFICATION TABLE FOR QUESTION PAPER DESIGN

Unit No.	Unit Title	Teaching Hours	Distribution of Theory Marks			
			R Level	U Level	A Level	Total Marks
I	Mechanics and Force System	04	02	02	02	06
II	Simple Lifting Machines	08	02	04	06	12
III	Resolution and Composition	10	02	04	08	14
IV	Equilibrium	10	02	02	10	14
V	Friction	08	02	04	06	12
VI	Centroid and Centre of Gravity	08	02	02	08	12
<b>Total</b>		<b>48</b>	<b>12</b>	<b>18</b>	<b>40</b>	<b>70</b>

Legends: R=Remember, U=Understand, A=Apply and above (Bloom's Revised taxonomy)

Note: This specification table provides general guidelines to assist student for their learning and to teachers to teach and assess students with respect to attainment of UOs. The actual distribution of marks at different taxonomy levels (of R, U and A) in the question paper may vary from above table.

#### 10. SUGGESTED STUDENT ACTIVITIES

Other than the classroom and laboratory learning, following are the suggested student-related co-curricular activities which can be undertaken to accelerate the attainment of the various outcomes in this course:

- Collect five different photographs indicating concurrent, parallel, general force system in equilibrium.
- Prepare a table of type of machine and relevant industrial application.
- Collect five different situations where law of moment plays an important role.
- Prepare models representing various types of supports (hinged, roller and fixed)
- Illustrate situations wherein friction is essential and not essential.
- Prepare models in the form of geometrical figures and solids and locate centroid and centre of gravity of them.

#### 11. SUGGESTED SPECIAL INSTRUCTIONAL STRATEGIES (if any)

These are sample strategies, which the teacher can use to accelerate the attainment of the various outcomes in this course:

- Massive open online courses (MOOCs) may be used to teach various topics/sub topics.
  - 'L' in item No. 4 does not mean only the traditional lecture method, but different types of teaching methods and media that are to be employed to develop the outcomes.
  - About 15-20% of the topics/sub-topics which is relatively simpler or descriptive in nature is to be given to the students for self-directed learning and assess the development of the COs through classroom presentations (see implementation guideline for details).
  - With respect to item No.10, teachers need to ensure to create opportunities and provisions for co-curricular activities.
- Guide student(s) in undertaking micro-projects.

#### 12. SUGGESTED MICRO-PROJECTS

Only one micro-project is planned to be undertaken by a student assigned to him/her in the beginning of the semester. S/he ought to submit it by the end of the semester to develop the industry oriented COs. Each micro-project should encompass two or more COs which are in fact, an integration of PrOs, UOs and ADOs. The micro-project could be industry application based, internet-based, workshop-based, laboratory-based or field-based. Each student will have to maintain dated work diary consisting of individual contribution in the project work and give a seminar presentation of it before submission. The total duration of the micro-project should not be less than 16 (sixteen) student engagement hours during the course.

In the first four semesters, the micro-project could be group-based. However, in higher semesters, it should be individually undertaken to build up the skill and confidence in every student to become problem solver so that s/he contributes to the projects of the industry. A suggestive list is given here. Similar micro-projects could be added by the concerned faculty:

- Types of Forces:** Prepare chart showing real-life examples indicating various types of forces
- Lifting Machine:** Collect photographs of specific simple lifting machine and relate these machines with the machines being studied and prepare models of simple lifting machines using tools in "MECHANO" and "MECHANIX"
- Types of support:** Prepare chart showing actual and corresponding schematic diagram of various type of support
- Beams:** Prepare models of beam subjected to point loads, uniformly distributed loads, simply supported, overhang and cantilever type beam.
- Friction:** Prepare chart regarding type of friction in various field conditions and collect data regarding coefficient of friction by referring books, Determine coefficient of friction for three different types of surfaces
- Centre of Gravity:** Prepare a chart of situations wherein concept of Centre of Gravity is vital.

#### 13. SUGGESTED LEARNING RESOURCES

S. No.	Title of Book	Author	Publication
1	Applied Mechanics	Khurmi, R.S.	S Chand & Co. New Delhi 2014 ISBN: 9788121916431
2	Engineering Mechanics	Ramamrutham, S.	S Chand & Co. New Delhi 2008 ISBN:9788187433514
3	Foundations and Applications of Applied Mechanics	Ram, H. D.; Chauhan, A. K.	Cambridge University Press, Thomson Press India Ltd., New Delhi, 2015, ISBN: 9781107499836
4	Engineering Mechanics- Statics, Vol. I	Meriam, J. L.; Kraige, L.G.	Wiley Publication, New Delhi, ISBN: 978-81-265-4396

#### 14. SOFTWARE/LEARNING WEBSITES

- <http://www.asnu.com.au>
- [www.youtube.com](http://www.youtube.com) for videos regarding machines and applications, friction
- [www.nptel.ac.in](http://www.nptel.ac.in)
- [www.discoveryforengineers.com](http://www.discoveryforengineers.com)



**Program Name** : Civil Engineering Program Group  
**Program Code** : CE/CR/CS  
**Semester** : Second  
**Course Title** : Civil Engineering Workshop and Practice  
**Course Code** : 22008

**1. RATIONALE**

General Civil Engineering Practices is a basic engineering course. The knowledge of basics of civil Engineering operations like masonry, mixing, concreting, finishing works is essential for technician to perform his/her duties in industries. Therefore, an opportunity is created through this course to develop basic skills with the safety aspects required for the same. Students should be able to supervise construction activities and use quality control techniques and maintain tools and equipments with safety to self, co-workers and the constructed components of the building. Working in field develops the attitude of team working and safety awareness. This course provides the unique experience of field work

**2. COMPETENCY**

The aim of this course is to help the student to attain the following industry identified competency through various teaching learning experiences:

- Perform basic civil engineering jobs using relevant tools.

**3. COURSE OUTCOMES (COs)**

The theory, practical experiences and relevant soft skills associated with this course are to be taught and implemented, so that the student demonstrates the following *industry oriented* COs associated with the above mentioned competency:

- Identify the various construction activities at site.
- Perform masonry job activities.
- Perform plumbing job activities.
- Identify finishing jobs related to building construction.
- Identify the various components of typical civil structures like road, culvert/bridges.

**4. TEACHING AND EXAMINATION SCHEME**

Teaching Scheme			Credit (L+T+P)	Examination Scheme												
L	T	P		Theory						Practical						
				Paper Hrs.	ESE Max	ESE Min	PA Max	PA Min	Total Max	Total Min	ESE Max	ESE Min	PA Max	PA Min	Total Max	Total Min
-	-	4	4	--	--	--	--	--	--	--	50#	20	50~	20	100	40

(~): For the *practical only* courses, the PA has two components under practical marks i.e. the assessment of practicals (seen in section 6) has a weightage of 60% (i.e.30 marks) and micro-project assessment (seen in section 12) has a weightage of 40% (i.e.20 marks). This is designed to facilitate attainment of COs holistically, as there is no theory ESE.

**Legends:** L-Lecture; T-Tutorial/Teacher Guided Theory Practice; P-Practical; C-Credit; ESE-End Semester Examination; PA-Progressive Assessment.

**5. COURSE MAP (with sample COs, PrOs, UOs, ADOs and topics)**

This course map illustrates an overview of the flow and linkages of the topics at various levels of outcomes (details in subsequent sections) to be attained by the student by the end of the course, in all domains of learning in terms of the industry/employer identified competency depicted at the centre of this map.

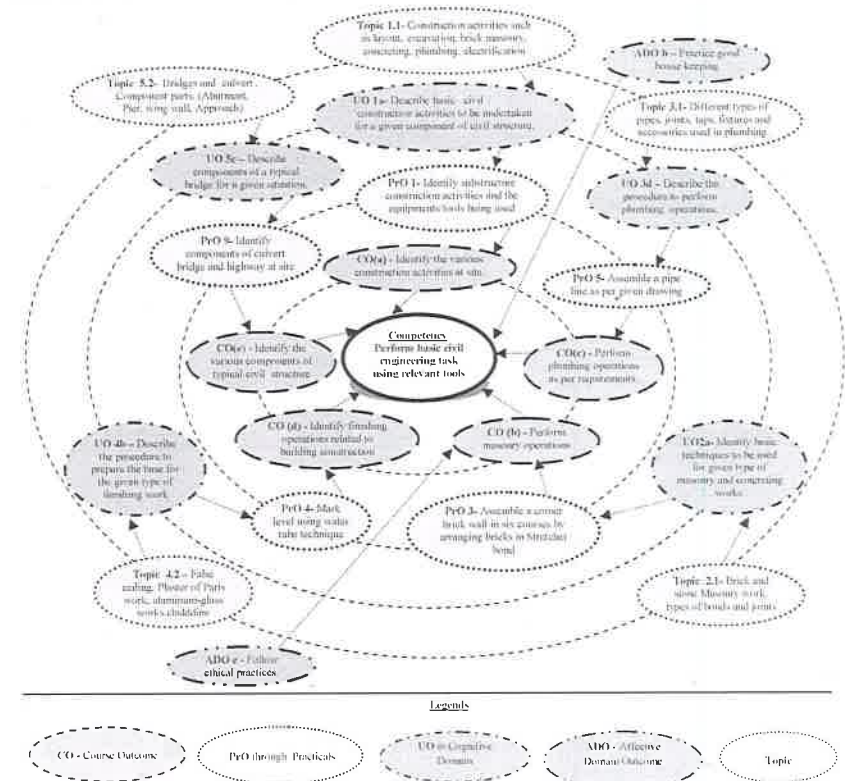


Figure 1 - Course Map

**6. SUGGESTED PRACTICAL LEARNING OUTCOMES/TUTORIALS**

The practicals in this section are PrOs (i.e. sub-components of the COs) to be developed and assessed in the student for the attainment of the competency.

S. No.	Practical Outcomes (PrOs)	Unit No.	Approx. Hrs. required
1	Identify the substructure construction activities and the equipments/tools being used at site during the visit. Part I	I, II	02*
2	Identify the substructure construction activities and the equipments/tools being used at site during the visit. Part II	I, II	02



S. No.	Practical Outcomes (PrOs)	Unit No.	Approx. Hrs. required
3	Identify the substructure construction activities and the equipments/tools being used at site during the visit. Part III	I, II	02
4	Identify the substructure construction activities and the equipments/tools being used at site during the visit. Part IV	I, II	02
5	Assemble a corner brick wall in six courses by arranging bricks in Stretcher bond. Ensure that wall is in line, plumb and at right angle to a existing wall (Group of 10 students)	II	02*
6	Assemble a corner brick wall in six courses by arranging bricks in Stretcher bond. Ensure that wall is in line, plumb and at right angle to a existing wall (Group of 10 students). Part I	II	02
7	Assemble a corner brick wall in six courses by arranging bricks in Stretcher bond. Ensure that wall is in line, plumb and at right angle to a existing wall (Group of 10 students). Part II	II	02
8	Assemble a corner brick wall in six courses by arranging bricks in Stretcher bond. Ensure that wall is in line, plumb and at right angle to a existing wall (Group of 10 students). Part III	II	02
9	Assemble a corner brick wall in six courses by arranging bricks in Stretcher bond. Ensure that wall is in line, plumb and at right angle to a existing wall (Group of 10 students) Part IV	II	02
10	Identify the superstructure construction activities and the equipments/tools being used at site during the visit Part I	III, IV	02*
11	Identify the superstructure construction activities and the equipments/tools being used at site during the visit Part II	III, IV	02
12	Identify the superstructure construction activities and the equipments/tools being used at site during the visit Part III	III, IV	02
13	Identify the superstructure construction activities and the equipments/tools being used at site during the visit Part IV	III, IV	02
14	Mark level of given height from ground level at different locations in the specified location using water pipe technique. Part I (Group of 10 students)	II, IV	02*
15	Mark level of given height from ground level at different locations in the specified location using water pipe technique. Part II (Group of 10 students)	II, IV	02
16	Mark level of given height from ground level at different locations in the specified location using water pipe technique. Part III (Group of 10 students)	II, IV	02
17	Mark level of given height from ground level at different locations in the specified location using water pipe technique. Part IV (Group of 10 students)	II, IV	02
18	Assemble a pipe line as per given drawing using pipes of one inch diameter, pipes of half inch diameter, nipple, reducer, union, valves T, elbow and then dissemble this pipe line. Part I	III	02*
19	Assemble a pipe line as per given drawing using pipes of one inch diameter, pipes of half inch diameter, nipple, reducer, union, valves T, elbow and then dissemble this pipe	III	02

S. No.	Practical Outcomes (PrOs)	Unit No.	Approx. Hrs. required
	line Part II		
20	Assemble a pipe line as per given drawing using pipes of one inch diameter, pipes of half inch diameter, nipple, reducer, union, valves T, elbow and then dissemble this pipe line. Part III	III	02
21	Assemble a pipe line as per given drawing using pipes of one inch diameter, pipes of half inch diameter, nipple, reducer, union, valves T, elbow and then dissemble this pipe line. Part IV	III	02
22	Test the quality of cement on site/Laboratory. Part I	IV	02*
23	Test the quality of cement on site/Laboratory. Part II	IV	02
24	Test the quality of cement on site/Laboratory. Part III	IV	02
25	Identify types of bent up bar and stirrups at site during the field visit for the reinforcement for beams, column and slab. Part I	IV	02*
26	Identify types of bent up bar and stirrups at site during the field visit for the reinforcement for beams, column and slab. Part II	IV	02
27	Carry out field test on bricks at site. Part I	IV	02*
28	Carry out field test on bricks at site. Part II	IV	02
29	Carry out field test on bricks at site. Part III	IV	02
30	Identify the various components of the culvert at site	V	08*
31	Identify the various components of the bridge at site	V	08
32	Identify the various components of the highways at site	V	08
	<b>Total</b>		<b>64</b>

**Note**

- A suggestive list of PrOs is given in the above table. More such PrOs can be added to attain the COs and competency. A judicious mix of minimum 24 or more practical LOs/tutorials need to be performed, out of which, the practicals marked as '\*' are compulsory, so that the student reaches the 'Precision Level' of Dave's 'Psychomotor Domain Taxonomy' as generally required by the industry.
- Hence, the 'Process' and 'Product' related skills associated with each PrO of the laboratory/workshop/field work are to be assessed according to a suggested sample given below:

S. No.	Performance Indicators	Weightage in %
1	Preparation of experimental set up	20
2	Setting and operation	20
3	Safety measures	10
4	Observations and Recording	10
5	Interpretation of result and Conclusion	20
6	Answer to sample questions	10
7	Submission of report in time	10
	<b>Total</b>	<b>100</b>

The above PrOs also comprise of the following social skills/attitudes which are Affective Domain Outcomes (ADOs) that are best developed through the laboratory/field based experiences:





- Follow safety practices.
- Practice good housekeeping.
- Demonstrate working as a leader/a team member.
- Maintain tools and equipment.
- Follow ethical practices.

The ADOs are not specific to any one PrO, but are embedded in many PrOs. Hence, the acquisition of the ADOs takes place gradually in the student when s/he undertakes a series of practical experiences over a period of time. Moreover, the level of achievement of the ADOs according to Krathwohl's 'Affective Domain Taxonomy' should gradually increase as planned below:

- 'Valuing Level' in 1<sup>st</sup> year
- 'Organising Level' in 2<sup>nd</sup> year
- 'Characterising Level' in 3<sup>rd</sup> year.

#### 7. MAJOR EQUIPMENT/ INSTRUMENTS REQUIRED

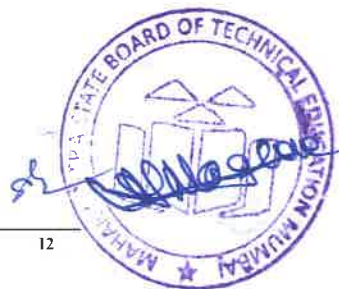
The major equipment with broad specification mentioned here will usher in uniformity in conduct of experiments, as well as aid to procure equipment by authorities concerned.

S. No.	Equipment Name with Broad Specifications	Exp. No.
1	Raw material such as bricks of standard size 230 mm x 115 mm x 75 mm.	3,8
2	Trowels (Brick, Buttering, Pointing) , triangular, ranging in size up to about 11 inches (279.40 mm) long and from 101.6 mm to 203.2 mm wide i.e. (4 to 8 inches wide).	3
3	Portable Hammer , Spade, Pans (ghamela), Thread, lime	3
4	Square, mason's level, and straightedge 28.57 mm to 38.10 mm and the middle portion of the top edge from 152.40 mm to 254 mm wide	3
5	Levels and mason's line, brushes.	3
6	String, Level / Water tube, Plumb bob, Right Angle	4
7	The mason's level to establish "plumb" and "level" lines	4
8	Plumbing materials such as pipes and accessories for different sizes and materials, pipe wrench	5
9	Pipe Bending Machine	5
10	Pipe Vice – 100 mm	5
11	Pipe Cutter- 50 mm	5
12	Ordinary Portland Cement	3,6
13	Reinforcement bar, 10 mm dia. , binding wire and bending tool	7
14	Bricks of standard size 230 mm x 115 mm x 75 mm.	3,8

#### 8. UNDERPINNING THEORY COMPONENTS

The following topics/subtopics should be taught and assessed in order to develop LOs in cognitive domain for achieving the COs to attain the identified competency.

Unit	Unit Outcomes (UOs) (in cognitive domain)	Topics and Sub-topics
<b>Unit – I Overview of Constructi on activities</b>	1a. Describe basic construction activities to be undertaken for the given component of civil structure. 1b. Identify the construction activities at the given site. 1c. Identify the tools used for the given type of foundation layout. 1d. Describe different safety precautions to be taken at the given construction site.	1.1. Construction activities such as layout, excavation, brick masonry, concreting, plumbing, electrification, Interdependency of various activities 1.2. Workmanship and Safety precautions
<b>Unit – II Masonry and Concreting</b>	2a. Identify the basic techniques to be used for the given type of masonry and concreting works with justification. 2b. Identify the relevant quality control measures to be adopted in operations related to the given type of masonry and concreting with justification. 2c. Describe the methods of plastering and pointing to be undertaken in the given situation. 2d. Describe the methods of the formwork for the given type of building. 2e. Identify type of bonds in the given type of brickwork.	2.1 Brick and stone Masonry work, Types of bonds and joints (vertical and horizontal). 2.2 Line dori, plumb bob, right angle and water level tube. 2.3 Plastering, Pointing. 2.4 Proper mixing of concrete, concrete laying. 2.5 Use of concrete Mixtures and Vibrators, different types of Vibrators. 2.6 Formwork, Scaffolding. 2.7 Centring and Shuttering.
<b>Unit- III Plumbing Services</b>	3a Identify the plumbing tools and fixtures in the given situation with justification. 3b Select the pipe fittings, hand tools and machinery for the given type of work with justification. 3c Select the type of plumbing tools and machinery for the given situation with justification. 3d Describe the procedure to perform plumbing operations for the given condition. 3e Describe the safety precautions to be undertaken for the given site.	3.1 Different types of pipes, joints, taps, fixtures and accessories used in plumbing. 3.2 Components (pipes, valves, bends.) used in water supply/sanitary/sewerage lines.
<b>Unit- IV Finishing Works</b>	4a. Describe the operations to be undertaken related to the given situation of false ceiling, aluminum partitions, plastering work. 4b. Describe the procedure to prepare the	4.1 Flooring, skirting and dado. 4.2 False ceiling, Plaster of Paris (POP) work, aluminum – glass works, cladding. 4.3 Whitewash and painting:



Unit	Unit Outcomes (UOs) (in cognitive domain)	Topics and Sub-topics
	base for the given type of finishing /painting work. 4c. Choose the relevant aluminum section for the given type of work with justification. 4d. Describe whitewashing and Painting procedure for the given type of walls/steel frames/wooden structure.	Tools required, brush, roller and spray painting, preparation of surface for timber and steel members for painting.
<b>Unit- V Constructi on of Road, culverts/ bridges</b>	5a. Identify relevant materials for the given type of road construction with justification. 5b. Describe the types and components of road for the given situation. 5c. Describe the components of typical bridge for the given situation. 5d. Describe the components of a typical Culvert in the given situation. 5e. Identify relevant materials for construction of given type of bridge/culvert.	5.1 Types of road, components of road, (carriage way, shoulder, camber, gradient). 5.2 Bridges and Culvert. component parts. (Abutment, Pier, Wing wall, Approach).

Note: To attain the COs and competency, above listed UOs need to be undertaken to achieve the 'Application Level' and above of Bloom's 'Cognitive Domain Taxonomy'.

#### 9. SUGGESTED SPECIFICATION TABLE FOR QUESTION PAPER DESIGN

- Not applicable -

#### 10. SUGGESTED STUDENT ACTIVITIES

Other than the classroom and laboratory learning, following are the suggested student-related *co-curricular* activities which can be undertaken to accelerate the attainment of the various outcomes in this course:

- Undertake a market survey of local dealers for procurement of civil engineering materials, plumbing materials and finishing items
- Organize a visit to Construction sites of different types such as simple residential buildings, malls, multistoried buildings. Observe the course/topic based practices on the field.
- Teacher guided self-learning activities
- Course/ library /internet based mini-projects.
- Develop Power point presentation or animation for activities seen during field visit.

#### 11. SUGGESTED SPECIAL INSTRUCTIONAL STRATEGIES (if any)

These are sample strategies, which the teacher can use to accelerate the attainment of the various outcomes in this course:

- Massive open online courses (*MOOCs*) may be used to teach various topics/sub topics.
- 'L' in item No. 4 does not mean only the traditional lecture method, but different types of teaching methods and media that are to be employed to develop the outcomes.

- About 15-20% of the topics/sub-topics which is relatively simpler or descriptive in nature is to be given to the students for *self-directed learning* and assess the development of the COs through classroom presentations (see implementation guideline for details).
- With respect to item No.10, teachers need to ensure to create opportunities and provisions for *co-curricular activities*.
  - Guide student(s) in undertaking micro-projects.
  - Arrange visit to nearby construction sites for understanding various construction stages and construction activities
  - Show video/animation films to explain various processes like, excavation, foundation, brickwork, plastering, laying water supply and sewer pipe line
  - Prepare construction activity chart for various civil engineering stages.

#### 12. SUGGESTED MICRO-PROJECTS

*Only one micro-project* is planned to be undertaken by a student assigned to him/her in the beginning of the semester. S/he ought to submit it by the end of the semester to develop the industry oriented COs. Each micro-project should encompass two or more COs which are in fact, an integration of PrOs, UOs and ADOs. The micro-project could be industry application based, internet-based, workshop-based, laboratory-based or field-based. Each student will have to maintain dated work diary consisting of individual contribution in the project work and give a seminar presentation of it before submission. The total duration of the micro-project should not be less than 16 (*sixteen*) student engagement hours during the course.

In the first four semesters, the micro-project could be group-based. However, in higher semesters, it should be individually undertaken to build up the skill and confidence in every student to become problem solver so that s/he contributes to the projects of the industry. A suggestive list is given here. Similar micro-projects could be added by the concerned faculty:

- Bill Preparation** (Group of 4-5 students) – Prepare bill of materials for given pipeline layout
- Masonry and concreting** - Each student will collect the information regarding the IS provisions for the construction materials like cement, bricks, reinforcement and sand.
- Finishing Work** – Collect the information from local market regarding the types, thickness, manufacturer, cost of various brands and make of aluminum extruded sections along with its specifications laid in IS code. (Individual activity)
- Plumbing** – Download the specifications for plumbing tools such as bench vice, hammers, pipe wrench and pipe accessories.
- Masonry and concreting** – Undertake a market survey of cement aggregate and sand of various specifications from local dealers (Group of five students)
- Plumbing** – Collect the technical information for various plumbing accessories such as GI/PVC pipes, bend, union, couplings of various dimensions and write a brief reports (Individual activity)
- Masonry and concreting (Individual activity)** –
  - Collect five samples of bricks from different suppliers and test them in field to assess its quality and write a report on it with reference to its constituents and process of manufacturing.
  - Prepare a mud /cement mortar of various proportions 1:3 and apply plaster on a plain wall of 120 mm X 90 mm and observe the line, level and plumb
  - Prepare a cement concrete of proportion 1:2:4, 1:3:6 and 1:4:8 and prepare a cubical block of it to determine its strength. (Individual activity)



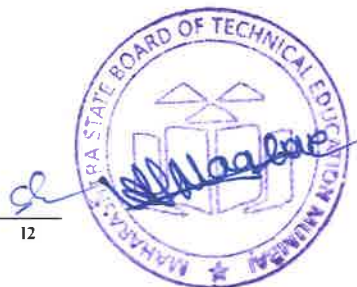
- iv. Masonry and concreting –Collect the list of available brand of flooring tiles with their IS specifications and make a report of it.
- f. **Masonry and concreting** (Group of five students) – Undertake the local survey for various shuttering material along with its specifications.
- g. **Masonry and concreting** .(Group of ten students) – Assemble and dissemble the shuttering material for a beam of given dimension using appropriate material as directed by concern teacher
- h. **Finishing Work** (Individual activity) - Undertake the survey for different brands of paint, painting tools and prepare a report with reference to the following points:
  - i. Constituents of paint material
  - ii. Coverage area of finishing surface.
  - iii. Cost.
  - iv. Durability and aesthetic features.

### 13. SUGGESTED LEARNING RESOURCES

S. No.	Title of Book	Author	Publication
1	PWD- Standard Data Book for Building Work	PWD	PWD, Government of Maharashtra, Mumbai.
2	CPWD Specifications (Vol.-I and II)	CPWD	CPWD, Govt. of India, New Delhi.
3	The Practical design of Structural Elements in Timber	Bull, J.W.	Gower Press, London, 1989, ISBN: 9780566090288
4	Basic Plumbing With Illustrations	Massey, Howard C.	Craftsman Book Co; California, ISBN: 9780934041997
5	Modern Plumbing	Baker, E.Keith Blanken	Goodheart-Willcox Co. ISBN: 978-1590703502
6	District Schedule of rates, (DSR)	PWD	PWD, Government of Maharashtra, Mumbai.
7	A To Z Of Practical Building Construction & its Management	Mantri Sandeep	Satya Prakashan, New Delhi; 2015; ISBN : 9788176842051

### 14. SOFTWARE/LEARNING WEBSITES

- a. <http://www.asnu.com.au>
- b. <http://www.iamcivilengineer.com/-building-design-and.html>
- c. [www.mahapwd.com/](http://www.mahapwd.com/)
- d. [cpwd.gov.in/](http://cpwd.gov.in/)
- e. <https://wrd.maharashtra.gov.in/>







Program Name: All Branches of Diploma in Engineering and Technology.

Program Code: CE/CR/CS/CH/PS/CM/CO/IF/CW/DE/EJ/EN/EQ/ET/EX/IE/MU/EE/

EP/EU/IS/IC/AE /FG/ME/PG/PT/DC/TX/TC

Semester : Second

Course Title : Business Communication Using Computers

Course Code : 22009

1. RATIONALE

Communication is the key factor for smooth and efficient functioning of any industry or business activity. Effective business communication is the lifeblood of any organization and is required to maintain quality and progress. The efficacy of business communication skills are essential for engineering professionals for instructing, guiding and motivating subordinates to achieve desired goals at work place. It is very crucial for an entrepreneur to run organization successfully by communicating effectively and skillfully with employees, customers and investors. Thus this course has been designed to enhance the skills to 'Communicate effectively and skillfully at workplace.'

2. COMPETENCY

The aim of this course is to help the students to attain the following industry identified competency through various teaching learning experiences

- Communicate effectively and skillfully at workplace.

3. COURSE OUTCOMES (COs)

The theory, practical experiences and relevant soft skills associated with this course are to be taught and implemented, so that the student demonstrates the following industry oriented COs associated with the above-mentioned competency:

- Communicate effectively by avoiding barriers in various formal and informal situations.
- Communicate skillfully using non-verbal methods of communication.
- Give presentations by using audio-visual aids.
- Write reports using correct guidelines.
- Compose e-mail and formal business letters.

4. TEACHING AND EXAMINATION SCHEME

Teaching Scheme				Credit (L+T+P)	Examination Scheme											
L	T	P	Theory					Practical								
			ESE		PA		Total		ESE		PA		Total			
Paper Hrs.	Max	Min	Max	Min	Max	Min	Max	Min	Max	Min	Max	Min	Max	Min		
--	--	2	2	--	--	--	--	--	--	--	35@^	14	15~	06	50	20

(~^): For only practical courses, the PA (15 marks) has two components under practical marks i.e. the assessment of practical has a weightage of 60% (i.e.09 marks) and micro-project assessment has a weightage of 40% (i.e.06 marks). This is designed to facilitate attainment of COs holistically, as there is no theory ESE,

Legends: L-Lecture; T – Tutorial/Teacher Guided Theory Practice; P - Practical; C – Credit, ESE - End Semester Examination; PA - Progressive Assessment.

5. COURSE MAP (with sample COs, PrOs, UOs, ADOs and topics)

This course map illustrates an overview of the flow and linkages of the topics at various levels of outcomes (details in subsequent sections) to be attained by the student by the end of the course, in all domains of learning in terms of the industry/employer identified competency depicted at the centre of this map.

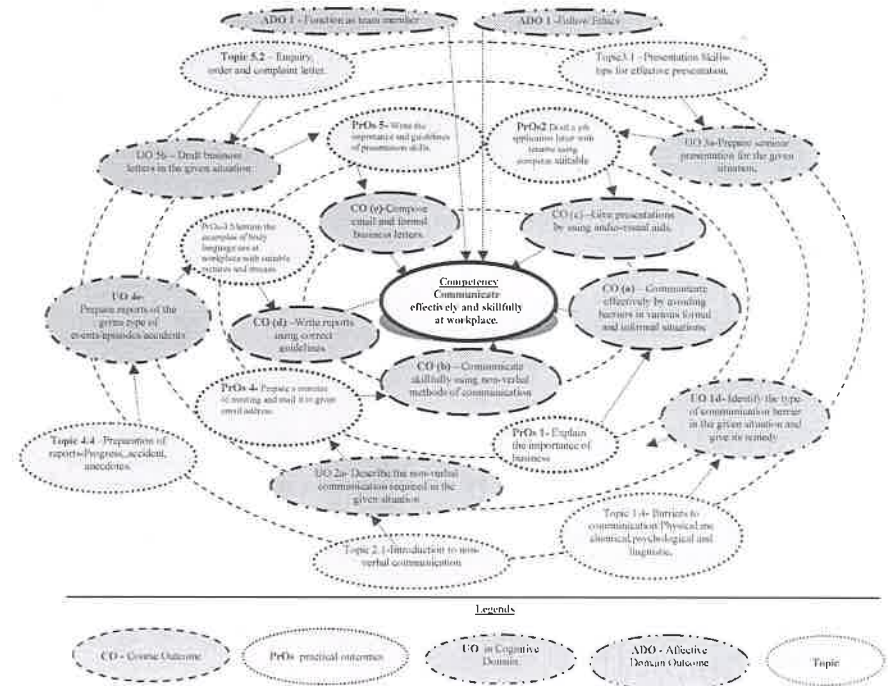


Figure 1 - Course Map

6. SUGGESTED PRACTICALS ACTIVITIES / EXERCISES (Integrate the theory in the laboratory when conducting practical)

The practical in this section are PrOs (i.e. sub-components of the COs) to be developed and assessed in the student for the attainment of the competency.

S. No.	Practical Outcomes (PrOs)	Unit No.	Approx. Hrs. required
1	Explain the importance of business communication for an organization using case study	I	2*



S. No.	Practical Outcomes (PrOs)	Unit No.	Approx. Hrs. required
2	Draft a job application letter with resume using computer.	V	2*
3	Mention the examples of body language use at workplace with suitable pictures and images.	II	2*
4	Prepare a minutes of meeting and mail it to given email address	VI	2
5	Write the importance and guidelines of presentation skills.	III	2*
6	Draft a detailed Progress Report.	IV	2*
7	Organize a debate on types of communication.	I & III	2
8	Summarize an industry report using techniques of summarizing.	IV	2
9	Draft a complaint letter on given topic.	V	2
10	Design PowerPoint presentation on any technical topic.	III	2*
11	Explain the eight principles of effective communication.	I	2*
12	Explain various non-verbal codes with examples.	II	2
13	Explain the importance of personal appearance stating tips of grooming for a professional.	II	2*
14	Draft a memo on given topic.	V	2
15	Present any Two barriers to communication using case study.	I	2*
16	Present a technical paper using IEEE format.	III	2*
			32

**Note**

i. A suggestive list of practical LOs is given in the above table, more such practical LOs can be added to attain the COs and competency. A judicious mix of minimum 12 or more practical LOs/tutorials need to be performed, out of which, the practicals marked as '\*' are compulsory, so that the student reaches the 'Precision Level' of Dave's 'Psychomotor Domain Taxonomy' as generally required by the industry. The size of batch for the practical should not exceed more than 21 students strictly for the maximum attainment of COs and PrOs.

ii. Hence, the 'Process' and 'Product' related skills associated with each LO of the laboratory/workshop/field work are to be assessed according to a suggested sample given below.

**7. MAJOR EQUIPMENTS / INSTRUMENTS REQUIRED**

The major equipment with broad specification mentioned here will usher in uniformity in conduct of experiments, as well as aid to procure equipment by authorities concerned.

S. No.	Equipment Name with Broad Specifications	Exp. S.No.
1	LCD Projector	All
2	Smart Board with networking	All
3	Language lab with internet	All
4	Printer	Wherever Applicable

**8. UNDERPINNING THEORY COMPONENTS**

The following topics/subtopics should be taught and assessed in order to develop UOs in cognitive domain for achieving the COs to attain the identified competency:

Unit	Unit Outcomes (UOs) (in cognitive domain)		Topics and Sub-topics
	Writing Skills	Speaking Skills	
<b>Unit – I Introduction to Business Communication</b>	1a. Describe the importance of the business communication in the given situation. 1b. Identify the missing element in the given communication process. 1c. Identify the type of communication in the given situation. 1d. Identify the type of communication barrier in the given situation and its remedy.	1e. Use different types of verbal and non-verbal communication for the given situation.	1.1 Introduction to Communication- Elements, Importance, Functions. 1.2 Types (meaning and importance) – Verbal (Oral-Written), Formal, Informal, Vertical, Horizontal and Diagonal communication. 1.3 Principles of effective communication. 1.4 Barriers to communication - Physical, mechanical, psychological and linguistic. 1.5 Business communication: Meaning, characteristics and importance.
<b>Unit– II Non-Verbal Communication</b>	2a. Describe the non-verbal communication required in the given situation. 2b. Describe personal appearance required in the given communication situation. 2c. Describe the given facial expressions.	2d. Use relevant facial expressions in the given situation. 2e. Answer questions after listening to presentations.	2.1 Introduction to Non-Verbal communication (Meaning and importance) 2.2 Body Language: Aspects of body language: gestures, eye contact, posture, facial expressions, personal appearance (dressing and grooming) vocalics. 2.3 Body language - positive and negative body language.
<b>Unit– III Presentation skills</b>	3a. Prepare seminar presentation for the given situation. 3b. Prepare debate points 'for' and 'against' the given topic. 3c. Prepare the points for computer presentation	3d. Make seminar presentation 3e. Participate in debate speaking 'for' or 'against' the given topic 3f. Make effective	3.1 Presentation skills- tips for effective presentation. 3.2 Guidelines for developing power point presentation. 3.3 Presenting Technical papers.



Unit	Unit Outcomes (UOs) (in cognitive domain)		Topics and Sub-topics
	Writing Skills for the given topic.	Speaking Skills computer presentations	
<b>Unit- IV Office Drafting</b>	4a. Draft the given notice using the relevant format. 4b. Draft the given memorandum using the relevant format. 4c. Prepare agenda for the given type of meetings. 4d. Prepare minutes of the given type of meetings. 4e. Prepare reports of the given type of events/episodes/ accidents	4f. Read the agenda of the given meeting. 4g. Read the report of the given event. 4h. Initiate telephone calls for given situation. 4i. Answer official phone calls for given situation.	4.1. Office drafting: Formats and Guidelines. 4.2. Formulating notices and memoranda. 4.3. Preparation of agenda and writing minutes of meetings. 4.4. Preparation of reports-progress reports, Accident reports, case study. 4.5. Summarizing techniques.
<b>Unit-V Business Correspondence</b>	5a. Respond to given job advertisements by writing your CV/ Resume. 5b. Draft business letters in the given situations. 5c. Draft complaint letters for the given situations. 5d. Compose E- mails with relevant for the given situation.		5.1 Business correspondence. 5.2 Enquiry, order and complaint letters. 5.3 E-mails- netiquettes. 5.4 Difference –Curriculum Vitae, Bio-data and Resume. 5.5 Job application and resume writing

*Note: To attain the COs and competency, above listed Learning Outcomes (UOs) need to be undertaken to achieve the 'Application Level' of Blooms's 'Cognitive Domain Taxonomy' Theory related topic should be covered during practical hours using multimedia.*

#### 9. SUGGESTED SPECIFICATION TABLE FOR INTERNAL END SEMESTER EXAMINATION

Unit No.	Unit Title	Distribution of practical Marks			
		R Level	U Level	A Level	Total Marks
I	Introduction to Business Communication	02	02	01	05
II	Non-verbal Communication	02	01	02	05
III	Presentation Skills	02	01	02	05
IV	Office Drafting	02	04	04	10
V	Business Correspondence	02	04	04	10
<b>Total</b>		<b>10</b>	<b>12</b>	<b>13</b>	<b>35</b>

*Legends: R=Remember, U=Understand, A=Apply and above (Bloom's Revised taxonomy)*

*Note: This specification table provides general guidelines to assist student for their learning and to teachers to teach and assess students with respect to attainment of PrOs and UOs. The actual distribution of marks at different taxonomy levels (of R, U and A) in the question paper may vary from above table.*

#### 10. SUGGESTED GUIDELINES FOR ASSESSMENT TOOL TO CONDUCT INTERNAL END SEMESTER EXAM (ESE) .

Weightage (20 Marks)	Weightage (15 Marks)	Total
A	B	
<b>Assessment based on PrOs, practicals conducted during semester</b> <b>Based on computer and written skill.</b> <b>(Minimum four questions each five marks)</b> <b>Sample questions:</b> <b>Eg. I Draft an email to The manager regarding the shortage of raw material at production department.</b> <b>(Note-submit the printout of mail. (Computer based)</b> <b>Eg. II Write job application with resume. ( written )</b>	<b>Oral examination based on UOs Topics mentioned in syllabus.</b> <b>(Minimum five questions each two marks to be asked )</b> <b>Eg. I Explain the importance of communication in professional life.</b> <b>II. State any four guidelines of presentation skills.</b>	<b>(35 Marks)</b> <b>A+B</b> <b>Duration: 2 hours</b>

#### SUGGESTED STUDENT ACTIVITIES

Other than the classroom and laboratory learning, following are the suggested student-related *co-curricular* activities which can be undertaken to accelerate the attainment of the various outcomes in this course:

- Collect good articles from newspapers and magazines and read them with correct intonation.
- Listen to Business news on TV and radio.
- Watch videos of effective presentations on television and open learning sources for presentation skills and body language.
- Undertake micro-projects.

#### 11. SUGGESTED SPECIAL INSTRUCTIONAL STRATEGIES (if any)

These are sample strategies, which the teacher can use to accelerate the attainment of the various outcomes in this course:

- Massive open online courses (*MOOCs*) may be used to teach various topics/sub topics.



- b. 'L' in item No. 4 does not mean only the traditional lecture method, but different types of teaching methods and media that are to be employed to develop the outcomes.
- c. About 15-20% of the topics/sub-topics which is relatively simpler or descriptive in nature is to be given to the students for *self-directed learning* and assess the development of the COs through classroom presentations (see implementation guideline for details).
- d. With respect to item No.10, teachers need to ensure to create opportunities and provisions for *co-curricular activities*.
  - a. Arrange various communication activities using functional grammar.
  - b. Show video/animation films to develop listening skills and enhance vocabulary.
  - c. Use real life situations for explanation.
  - d. Prepare and give oral presentations.
  - e. Guide micro-projects in groups as well as individually.

## 12. SUGGESTED TITLES OF MICRO-PROJECTS

Only one micro-project is planned to be undertaken by a student that needs to be assigned to him/her in the beginning of the semester. S/he ought to submit it by the end of the semester to develop the industry oriented COs. Each micro-project should encompass two or more COs which are in fact, an integration of CrAs, UOs and ADOs. The micro-project could be industry application based, internet-based, workshop-based, laboratory-based or field-based. Each student will have to maintain dated work diary consisting of individual contribution in the project work and give a seminar presentation of it before submission. The total duration of the micro-project should not be less than 16 (sixteen) *student engagement* hours during the course.

In the first four semesters, the micro-project could be group-based. However, in higher semesters, it should be individually undertaken to build up the skill and confidence in every student to become problem solver so that s/he contributes to the projects of the industry. A suggestive list is given here. Similar micro-projects could be added by the concerned faculty:

- a. Study the personal appearance and grooming of employees visiting sales store, shopping mall in the vicinity.
- b. Comparative study of Bio-data, Resume and Curriculum vitae.
- c. A detailed study of guidelines required for presentation skills.
- d. Summarize technical content using English newspaper, magazines or online resources.
- e. Prepare a booklet on aspects of body language in pictorial form.
- f. A detailed study of the importance, of technical paper of technical paper presentation.
- g. Case study on the importance of Business communication in an organization.
- h. Report on various formal/business activities.
- i. Study of oral presentation of famous business leader.
- j. Detailed study of business etiquettes observed in organization.
- k. Summarize the business article with the help of English newspapers/magazines and other sources.

## 13. SUGGESTED LEARNING RESOURCES

S. No.	Title of Book	Author	Publication
1	Effective Communicator: Skills	M Ashraf Rizvi	Tata McGraw-Hill

S. No.	Title of Book	Author	Publication
2	Communication Skills	Sanjay Kumar and Pushp Lata	Oxford University Press
3	Personality Development and Soft Skills	Barun K. Mitra	Oxford University Press

## 14. SOFTWARE/LEARNING WEBSITES

- a. <https://www.britishcouncil.in/english/learn-online>
- b. <http://learnenglish.britishcouncil.org/en/content>
- c. <http://www.talkenglish.com/>
- d. [language-labs.com](http://www.language-labs.com/)
- e. [www.wordsworthelt.com](http://www.wordsworthelt.com)
- f. [www.notesdesk.com](http://www.notesdesk.com)
- g. <http://www.tutorialspoint.com>
- h. [www.studylecturenotes.com](http://www.studylecturenotes.com)
- i. [totalcommunicator.com](http://www.totalcommunicator.com)
- j. [www.speaking-tips.com](http://www.speaking-tips.com)

