BANGLADESH TECHNICAL EDUCATION BOARD

Agargaon, Sher-E-Bangla Nagar

Dhaka-1207.

04-YEAR DIPLOMA IN ENGINEERING CURRICULUM

COURSE STRUCTURE & SYLLABUS

(PROBIDHAN-2022)

CHEMICAL TECHNOLOGY

TECHNOLOGY CODE: 63

3rd SEMESTER

(Effective from 2022-2023 Academic Sessions)

DIPLOMA IN ENGINEERING CURRICULUM

COURSE STRUCTURE

(PROBIDHAN-2022)

TECHNOLOGY NAME: CHEMICAL TECHNOLOGY (63)

(3RD SEMESTER)

Sl. No.	Subject		Period Per Week		Credit	Marks Distribution						
						Theory Assessment			Practical Assessment			Grand Total
	Code	Name	Theory	Practical		Continuous	Final	Total	Continuous	Final	Total	
1	25811	Social Science	2	-	2	40	60	100	-	-	-	100
2	25922	Physics-II	3	3	4	60	90	150	25	25	50	200
3	25931	Mathematics-III	3	3	4	60	90	150	25	25	50	200
4	26331	Chemical Engineering Operation-I	2	3	3	40	60	100	25	25	50	150
5	26332	Industrial Chemistry	2	3	3	40	60	100	25	25	50	150
6	26333	Chemical Engineering Materials	2	3	3	40	60	100	25	25	50	150
7	26711	Basic Electricity	3	3	4	60	90	150	25	25	50	200
Total			**17**	**18**	**23**	**340**	**510**	**850**	**150**	**150**	**300**	**1,150**

Subject Code	Subject Name	Period per Week		Credit
25811	SOCIAL SCIENCE	T	P	C
		2	0	2

Rationale	Social science deals with the social, political, economic, cultural, ethical and historical aspects of society. All these aspects help to develop different subjects of social sciences- sociology, civics, political science, economics, ethics, history etc. Students can gather social skills through acquiring knowledge of these social sciences. Social science covers only such topics which will inspire diploma graduates to become good citizen and will enable them to associate an individual with other individuals in a society or workplace. The diploma graduates can gather knowledge of the basic concepts of social sciences, human endeavor in the economic system, the realities of Bangladesh economy, fundamental rights, contemporary social changes, historical background and socio-economic culture of Bangladesh. Social science helps to explain how society works, study of social science makes students an efficient citizen in a democracy. It is essential for communities and organization.
Learning Outcome (Theoretical)	**After undergoing the subject, students will be able to:** • Discuss the importance of social sciences and relationship among social sciences • Define the basic concepts of social sciences. • Describe the rights and duties of a citizen and qualities a good citizen. • Describe state, government, law and good governance • Explain the realities of Bangladesh economy and the current problems confronting the country • Describe the role of a Diploma Engineers in economic development of Bangladesh • Explain the process of socialization, the agencies of social control and contemporary social changes in Bangladesh • Explore our motherland and its historical background in terms of liberation war • Describe the independence of Bangladesh achieved through the leadership of Bangabandhu Sheikh Mujibur Rahman • Describe culture and civilization of Bangladesh & different ethnic groups in Bangladesh • Explain the United Nations (UN) and its role in maintaining world peace.

Detailed Syllabus (Theory)

Unit	Topics with Contents	Class (1 Period)	Final Marks
1.	**BASIC CONCEPTS OF SOCIAL SCIENCES** 1.1. Define social science. 1.2. Explain the importance of social sciences. 1.3. Describe the relationship among Civics, Economics, Political Science, Sociology and Ethics. 1.4. Define society, socialization, nation, nationality, citizen, citizenship and Constitution. 1.5. Define commodity, utility, value, price, wealth, consumption, income, savings, investment, wages and salary.	**03**	**05**
2.	**SOCIETY AND CITIZENSHIP** 2.1 Describe the evolutionary stages of society in sociological perspectives. 2.2 State the characteristics of society. 2.3 Describe the rights and duties of a citizen. 2.4 State the qualities of good citizen.	**02**	**04**
3.	**STATE, GOVERNMENT, LAW AND GOOD GOVERNANCE** 3.1 Define state, government, law and good governance 3.2 Mention the elements of state. 3.3 Discuss the forms of government. 3.4 Mention the main organs of government. 3.5 Describe the functions of legislature. 3.6 Describe the functions of executive. 3.7 Describe the functions of judiciary. 3.8 Discuss the sources of law. 3.9 Discuss the role of government to establish good governance.	**04**	**08**
4.	**SOCIALIZATION, SOCIAL CONTROL AND SOCIAL CHANGE** 4.1 Define socialization, social control and social change. 4.2 Describe the agencies of socialization. 4.3 Describe the agencies of social control. 4.4 Explain the contemporary social changes in Bangladesh.	**03**	**05**

	4.5 Discuss the role of information and communication technology for social changes in Bangladesh. 4.6 Discuss the impact of social changes.		
5.	**DEMAND, SUPPLY, UTILITY AND NATIONAL INCOME** 5.1 Define demand. 5.2 Define supply. 5.3 Explain the law of demand and supply. 5.4 Draw the demand and supply curve. 5.5 Explain the law of diminishing marginal utility. 5.6 Define national income. 5.7 Discuss GDP, GNP and NNP. 5.8 State the methods of measuring national income.	**04**	**08**
6.	**ECONOMIC AND SUSTAINABLE DEVELOPMENT OF BANGLADESH** 6.1 Define rural and urban economy. 6.2 Mention major problems of rural and urban economy. 6.3 Explain the reasons of migration of rural population to urban areas. 6.4 Discuss the role of Diploma graduate in the overall socio-economic development in Bangladesh. 6.5 Describe the importance and potential uses of natural resources for sustainable development.	**04**	**08**
7.	**THE PARTITION OF INDIA AND THE SUBSEQUENT POLITICAL EVENTS AND THE EMERGENCE OF INDEPENDENT-SOVEREIGN BANGLADESH** 7.1 Describe Language Movement and contemporary political and social events. 7.2 State the 6-point demands, the Agartala Conspiracy Case and the Mass Uprising in 1969. 7.3 Discuss the Election of 1970 and aftermath. 7.4 The Historic Liberation War in 1971 and the emergence of sovereign Bangladesh. 7.5 Discuss the reconstruction activities of independent-sovereign Bangladesh. 7.6 State the background of formulating the constitution of Bangladesh. 7.7 State the salient features of Bangladesh constitution.	**04**	**08**

	7.8 Discuss the fundamental rights of a citizen in the context of Bangladesh constitution. 7.9 Difference between human rights and fundamental rights.		
8.	**THE BANGABANDHU AND BANGLADESH** 8.1 State the biography of Bangabandhu Sheikh Mujibur Rahman. 8.2 State the historic speech of 7 March, 1971. 8.3 Describe the significance of historic speech of 7 March for independence of Bangladesh. 8.4 Describe the role of Bangabandhu Sheikh Mujibur Rahman for achieving independence of Bangladesh. 8.5 Discuss the mournful 15 August, 1975.	**03**	**05**
9.	**CULTURE AND CIVILIZATION OF BANGLADESH & DIFFERENT ETHNIC GROUPS IN BANGLADESH** 9.1 Define culture and civilization. 9.2 State the elements of culture and cultural lag. 9.3 Define ethnic group. 9.4 Discuss the social and cultural lifestyle of Garo, Chakma, Rakhain and Santhal. 9.5 Describe the role of archeological relics-Mahasthangarh, Paharpur and Mainamati in the socio-cultural development of Bangladesh.	**03**	**05**
10.	**THE UNITED NATIONS (UN) AND WORLD PEACE** 10.1 State the main organs of United Nations. 10.2 State the functions of General Assembly. 10.3 State the functions of Security Council. 10.4 State the specialized agencies of United Nations. 10.5 Discuss the role of United Nations. 10.6 Discuss the role of Bangladesh in the United Nations.	**02**	**04**
	Total	**32**	**60**

Recommended Books:

Sl	Book Name	Writer Name	Publisher Name & Edition
০১	পৌরনীতি	মোজাম্মেল হক	হাসান বুক হাউস
০২	রাষ্ট্রবিজ্ঞানের কথা	ড. এমাজউদ্দীন আহমদ	বাংলাদেশ বুক করপোরেশন লি.
০৩	সমাজবিজ্ঞান পরিচিতি	ড. মুহাম্মদ হাবিবুর রহমান	হাসান বুক হাউস
০৪	সমাজবিজ্ঞান সমীক্ষণ	ড. নাজমুল করিম	নওরোজ কিতাবিস্তান

০৫	অর্থনীতি	আনিসুর রহমান	অ্যাডর্ন পাবলিকেশনস
০৬	অর্থনীতি	মাসুম আলী	আইডিয়াল বুকস
০৭	বাংলাদেশের ইতিহাস	কে. আলী	আজিজিয়া বুক ডিপো
০৮	**‘Mahasthangarh’, ‘Paharpur’, ‘Mainamati’**	**Banglapedia**	**Bangladesh Asiatic Society**
০৯	বাংলাদেশের ইতিহাস ১৯৪৭-১৯৭১	ড. মো: মাহবুবর রহমান	সময় প্রকাশন
১০	বাংলাদেশের অভ্যুদয়	আবুল মাল আবদুল মুহিত	সময় প্রকাশন
১১	ইতিহাস: সমাজ ও সংস্কৃতি ভাবনা	মুসা আনসারী	বাংলা একাডেমি, ঢাকা
১২	অসমাপ্ত আত্মজীবনী	শেখ মুজিবুর রহমান	দি ইউনিভার্সিটি প্রেস লি.
১৩	কারাগারের রোজনামচা	শেখ মুজিবুর রহমান	দি ইউনিভার্সিটি প্রেস লি.

Subject Code	Subject Name	Period per Week		Credit
25922	PHYSICS-II	T	P	C
		3	3	4

Rationale	Physics is the basic science for all engineering students as well as diploma engineering students. To develop a foundation in scientific principles and processes for the understanding and application of various technology. It will help the students to study in technical subject of diploma engineering students.
Learning Outcome (Theoretical)	After undergoing the subject students will be able: 1. Identify and classify various types of source of heat and temperature. Describe determination procedure temperature of materials and heat capacity of solid and liquid. 2. Describe second law of thermodynamics, heat engine. 3. Describe static electricity current electricity, magnetism, reflection of light. Refraction of light, photoelectric effect, structure of atom, Theory of relativity, semiconductor and electronics.
Learning Outcome (Practical)	After undergoing the subject (Practical) the students will be able to: 1. Compare the operation of common thermometers. 2. Determine the co-efficient of liner expansion of solid. 3. Measure the specific heat capacity of Bruss, steel etc. 4. Determine the latent heat of fusion of ice. 5. Verify the Ohm's Law. 6. Determine the Mechanical Equivalent of Heat by using Joule's Calorimeter. 7. Verify the laws of reflection. 8. Find out the focal length of a concave minor. 9. Determine the refractive index of a glass slab 10. Determine the angle of minimum deviation & refractive index of prism.

Detailed Syllabus (Theory)

Unit	Topics with Contents	Class (1 Period)	Final Marks
1.	**THERMOMETRY** 1.1 Define Heat & Temperature 1.2 Mention the unit of Heat & Temperature 1.3 Relate between different scale of Temperature 1.4 State the construction and graduation of mercury Thermometer 1.5 Define specific heat, thermal capacity and water equivalent 1.6 Mention units of specific heat, thermal capacity and water equivalent 1.7 Explain the principle of Calorimetry, 1.8 Discuss various kinds of specific latent heat	3	5
2	**EFFECT OF HEAT ON MATERIALS** 2.1 Define linear, superficial and cubical expansion of solid. 2.2 Define Coefficient of linear, superficial and cubical expansion of solid. 2.3 Relate between coefficient of linear, superficial and cubical	4	7

	expansion of solid. 2.4 Explain the methods of heat transfer by conduction, convection and Radiation with example. 2.5 Define Thermal conductivity and Coefficient of the thermal conductivity 2.6 List the factors which determine the quantity of heat (Q) flowing through a material and Show that the quantity of heat flowing through a material can be found from $Q = \frac{KA(\theta_H - \theta_C)t}{d}$ 2.7 State Stefan-Boltzman Law. 2.8 State Newton's law of cooling. 2.9 State wine's law. 310 Explain Greenhouse effect.		
3	**NATURE OF HEAT AND MECHANICAL EQUIVALENT** 3.1 Describe the caloric theory and kinetic theory of heat 3.2 State the limitation of the caloric theory of heat 3.3 Explain the mechanical equivalent of heat 3.4 Explain the first law of thermodynamics 3.5 Explain Isothermal and adiabatic change. 3.6 Describe Specific heat of a gas, Molar specific heat or molar heat capacity. 3.7 Relate between pressure and volume of a gas in adiabatic change i, e; PV^{γ}=const. 3.8 Relate between C_P and C_V for and ideal gas (C_P-C_V=R)	**4**	**6**
4	**SECOND LAW OF THERMODYNAMICS** 4.1 Explain Reversible process and irreversible process. 4.2 Explain 2nd law of thermodynamics 4.3 Define heat engine 4.4 Explain the principle of Carnot's cycle 4.5 Mention the formula thermal efficiency of a heat engine 4.6 Distinguish between internal combustion engine and external combustion engine. 4.7 Describe Entropy 4.8 Mention the significant of entropy 4.9 Describe Change of entropy in a reversible and irreversible process.	**4**	**6**
5	**ELECTROSTATIC** 5.1 Define Charge and Nature of charge. 5.2 State the Law of attraction and repulsion of charge. 5.3 Explain the Coulomb's Law 5.4 Define Electric field and electric intensity. 5.5 Define Electric Potential and Potential difference 5.6 Relate between electric intensity and electric Potential. 5.7 Define Capacitor and capacitance. 5.8 Explain Energy of Capacitor. 5.9 Mention the Uses of capacitor.	**3**	**5**
6	**MAGNETISM** 6.1 Describe Earth's Magnetism. 6.2 Define Magnet, Magnetic Substance, Non-magnetic Substance, Magnetic Pole 6.3 Define Magnetic field, Magnetic Intensity. 6.4 Explain Magnetic Permeability, Magnetic Susceptibility 6.5 Explain Declination & inclination, Horizontal Component of	**4**	**7**

	Earth's Magnetic field B_H or H of Magnetic Elements of Earth 6.6 Classify Magnetic Materials 6.7 Compare among Diamagnetic, Paramagnetic and Ferromagnetic substance. 6.8 Describe Magnetic Domain.		
7	**REFLECTION OF LIGHT** 7.1 Define mirror (plane and spherical), image (real and virtual) and magnification. 7.2 Classify mirror and image 7.3 Describe the reflection of light 7.4 State the laws of reflection of right 7.5 Describe the verification of laws of reflection 7.6 Define pole, principal axis, center of curvature, radius of curvature, Principal focus in case of concave and convex mirrors 7.7 Express the general equation of concave and Convex mirror 7.8 Mention the uses of mirror and identify of Mirror.	3	6
8	**REFRACTION OF LIGHT** 8.1 Describe refraction of light 8.2 State the laws of refraction 8.3 Express the verification of laws of refraction 8.4 Describe critical angle and total internal refract reflection. 8.5 Relate between refractive index, minimum deviation of angle of the prism. 8.6 Define lens 8.7 Mention the kinds of lens. 8.8 Define center of curvature, radius of Curvature, Principal axis, first and second Principal focus, Optical center. 8.9 Derive general equation of the lens (Concave and convex) 8.10 Explain power of lens and equivalent of lens.	3	8
9	**PHYSICAL OPTICS** 9.1 Describe Electromagnetic Wave 9.2 Define Poynting Vector 9.3 Describe Electromagnetic Spectrum 9.4 Mention the wavelength of visible light spectrum 9.5 Define Light Year 9.6 Define Wave and Wave front 9.7 State the Huygens' Principle 9.8 Define Coherent Source 9.9 Define Interference of Light, Diffraction of Light and Polarization of Light. 9.10 Classify Interference of Light, Diffraction of Light and Polarization of Light.	4	8
10	**PHOTO ELECTRIC EFFECT** 10.1 Describe Electrical conductivity of gases. 10.2 Describe Discharge tube. 10.3 Define Cathode ray and X- Ray 10.4 Mention the properties of Cathode ray and X- Ray 10.5 Mention the use of X- Ray 10.6 Discuss photo electric effect 10.7 Derive Einstein's photo electric equation.	4	6

11	**STRUCTURE OF ATOM** 11.1 Describe the concept of structure of Atom 11.2 Discuss Thomson of Atomic models 11.3 Discuss Rutherford model of Atomic models 11.4 Discuss Bohr model of Atomic models 11.5 Derive the equation of Radius and Energy by using Bohr model 11.6 Explain Energy level of Electron 11.7 Derive the frequency of Photon by using Hydrogen atom Spectrum	**3**	**6**
12	**NUCLEAR PHYSICS** 12.1 Explain radioactivity 12.2 Describe radioactive rays 12.3 Deduce Radioactive decay law 12.4 Define half- life and mean-life of radioactive atom 12.5. Relate between half-life and radioactive decay constant 12.6 Describe Nuclear Reactor 12.7 Explain nuclear fission & fusion.	**3**	**7**
13	**MODERN PHYSICS** 13.1 Describe the concept of Modern Physics 13.2 Discuss about Reference frame 13.3 Explain Inertial and Non-Inertial Reference 13.4 Describe reference frame and Motion 13.5 Postulates of special Theory of Relativity 13.6 Explain the Galilean Transformation 13.7 Describe Lorentz Transformation 13.8 Define Black Holes and black body radiation.	**3**	**7**
14	**THEORY OF RELATIVITY AND ASTRO PHYSICS** 14.1 Describe Relativity 14.2 Discuss the types of Relativity 14.3 Explain Einstein's theory of Relativity 14.4 Describe the Relativity of time: Time Dilation 14.5 Discuss Relativity of Length : Length Contraction 14.6 Discuss Relativity of mass 14.6 Relate between mass and Energy ($E=mc^2$)	**3**	**6**
	Total	**48**	**90**

Detailed Syllabus (Practical)

Unit	Topics with Contents	Class (3 Period)	Continuous Marks
1	COMPARE THE OPERATION OF COMMON THERMOMETERS 1.1 Observe the different types of thermometer 1.2 Apply relation formula 1.3 Measure the temperature of liquid such normal water, hot water & ice 1.4 Calculate and compare the operation of thermometer 1.5 Maintain the record of the performance of experiment.	**1**	**1**

2	DETERMINE THE CO-EFFICIENT OF LINEAR EXPANSION OF A SOLID BY PULLINGER'S APPARATUS 2.1 Collect Pullinger's Apparatus , Thermometer and screw gauge 2.2 Apply heat to boil producer 2.3 Calculate the Linear expansion of solid 2.4 Maintain the record of the performance of experiment.	1	1
3	MEASURE THE SPECIFIC HEAT CAPACITY OF VARIOUS SUBSTANCES. (BRASS, STEEL) 3.1 Collect Calorimeter, Thermometer, Brass, Balance 3.2 Apply the formula for specific heat 3.3 Measure various terms according to formula 3.4 Calculate Specific heat capacity 3.5 Maintain the record of the performance of experiment.	1	2
4	DETERMINE THE LATENT HEAT OF FUSION OF ICE 4.1 Collect Calorimeter, Thermometer, Brass, Balance and ice 4.2 Apply the formula for latent heat of fusion 4.3 Measure various terms according to formula 4.4 Calculate latent heat of fusion 4.5 Maintain the record of the performance of experiment.	1	2
5	DETERMINE THE LATENT HEAT OF FUSION OF ICE 5.1 Collect Calorimeter, Thermometer, Brass, Balance and Vapor producer 5.2 Apply the formula for latent heat of Vapor 5.3 Measure various terms according to formula 5.4 Calculate latent heat of fusion 5.5 Maintain the record of the performance of experiment.	1	2
6	DETERMINE THE MECHANICAL EQUIVALENT OF HEAT BY USING JOULE'S CALORIMETER 6.1 Collect Joule's Calorimeter, Thermometer, Voltmeter 6.2 Apply Joule's formula for heat equivalent 6.3 Measure various terms according to formula 6.4 Determine the Mechanical Equivalent of Heat 6.5 Maintain the record of the performance of experiment.	2	2
7	VERIFY THE LAWS OF REFLECTION 7.1 Collect Plane mirror, pin and drawing board 7.2 Apply the laws of reflection 7.3 Measure the incident angle and reflection angle 7.4 Verify the laws of reflection 7.5 Maintain the record of the performance of experiment.	2	4
8	FIND OUT THE FOCAL LENGTH OF A CONCAVE MIRROR 8.1 Collect Optical bench & concave mirror 8.2 Apply focal length formula.	2	4

	8.3 Measure the object length & Image length 8.4 calculate the focal length by using formula 8.5 Maintain the record of the performance of experiment.		
9	DETERMINE THE REFRACTIVE INDEX OF A GLASS SLAB 9.1 Collect glass slab, pin, drawing paper and drawing board 9.2 Apply the Snell's law 9.3 Measure incident and refractive angle 9.4 calculate the refractive index 9.5 Maintain the record of the performance of experiment.	3	4
10	DETERMINE THE ANGLE OF MINIMUM DEVIATION AND REFRACTIVE INDEX OF A GLASS PRISM BY USING 1-D GRAPH 10.1 Collect prism, pin, drawing paper and drawing board 10.2 Apply the laws of minimum deviation 10.3 Measure incident angle and minimum deviation 10.4 Calculate the refractive index of prism 10.5 Maintain the record of the performance of experiment.	2	3
	Total	16	25

Recommended Books:

Sl	Book Name	Writer Name
	REFERENCE BOOKS: 1. Higher Secondary Physics - Second Part 2. A Text Book of Heat and Thermodynamics 3. A Text Book of Optics 4. Higher Secondary Physics - Second Part 5. Higher Secondary Physics -Second Part 6. Thermodynamics	- by Dr. Shahjahan Tapan - by N Subrahmanyam and Brij Lal - by N Subrahmanyam and Brij Lal - by Prof. Golam Hossain Pramanik - by Ishak Nurun Nabi - by K K Ramalingam

Website References:

Sl	Web Link	Remarks
1	www.nctb.gov.bd	

Subject Code	Subject Name	Period per Week		Credit
25931	Mathematics-III	T	P	C
		3	3	4

Rationale	To be able to understand the binomial expansion. To enable to calculate the areas of regular polygons, hexagons, octagon, hydraulic mean a depth (HMD) of a Channel, area occupied by water of circular Culvert. Excavation work. To provide the ability to calculate volume of regular solids like pyramid, frustum of pyramid, Prismoid, wedge and area of curved surfaces. To understand the Laplace transformation
Learning Outcome (Theoretical)	Express Binomial expansion. To able to find the area triangle, quadrilateral, parallelogram, regular polygon & circle volume of solid Shaped. Able to solve problems related to area & volume of various type of shaped.
Learning Outcome (Practical)	**Able to solve problems related to area and volume of various type of shaped.**

Detailed Syllabus (Theory)

Unit	Topics with Contents	Class (1 Period)	Final Marks
1	**MENSURATION(Area of Triangle):** 1.1 Find the area of triangle in the form, A= $\frac{\sqrt{3}}{4}a^2$, a = length of a side of equilateral triangle. A= $\frac{c}{4}\sqrt{4a^2-c^2}$, where a = length of equal sides, c = third side. A= $\sqrt{s(s-a)(s-b)(s-c)}$, where a, b, c = length of the sides of a Triangle and 2s is the perimeter of the triangle. 1.2 Use formula in 1.1 to solve problems.	**4**	**8**
2	**MENSURATION (Areas of quadrilateral, Parallelogram, rhombus & trapezium)** 2.1 Define quadrilateral & Parallelogram. 2.2 Find the areas of quadrilateral when off sets are given. 2.3 Find the areas of a parallelogram. 2.4 Solve problems using above formulae. 2.5 Define rhombus & trapezium. 2.6 Find the areas of rhombus when the diagonals are given. 2.7 Find the areas of trapezium in terms of its parallel sides and the perpendicular distance between them. 2.8 Solve problems related to rhombus & trapezium.	**3**	**6**
3	**MENSURATION(Finding areas of regular polygon):** 3.1 Define a regular polygon. 3.2 Find the area of a regular polygon of n sides, when (i) The length of one side and the radius of inscribed circle are given. (ii) The length of one side and the radius of circumscribed circle are given. 3.3 Find the area of a regular. a) Hexagon, Octagon when length of side is given.	**3**	**6**

Unit	Topics with Contents	Class (1 Period)	Final Marks
	3.4 Solve problems of the following's types: A hexagonal polygon 6 m length of each side has a 20 cm width road surrounded the polygon. Find the area of the road.		
4	**MENSURATION(Areas of circle, sector and segment):** 4.1 Define circle, circumference, sector and segment. 4.2 Find the circumference and area of a circle when its radius is given. 4.3 Find the area of sector and segment of a circle. 4.4 Solve problems related to the above formulae.	**3**	**6**
5	**MENSURATION(Area & Volume of a rectangular solid):** 5.1 Define rectangular solid and a cube. 5.2 Find geometrically the volume of a rectangular solid when its length, breadth and height are given. 5.3 Find the volume and diagonal of a cube when side is given. 5.4 Solve problems with the help of 5.2 & 5.3.	**3**	**5**
6	**MENSURATION(Surface area & volume of a prism):** 6.1 Define a prism. 6.2 Explain the formulae for areas of curved surfaces of prism. 6.3 Explain the formulae for volume of prism when base and height are given. 6.4 Solve problems related to 6.2, 6.3	**3**	**5**
7	**MENSURATION (Area & volume of Parallelepiped and cylinder):** 7.1 Define a parallelepiped and a cylinder. 7.2 Explain the formulae for areas of curved surfaces of parallelepiped and cylinder. 7.3 Explain the formulae for volume of parallelepiped and cylinder when base and height are given. 7.4 Solve problems related to 7.1, 7.2, 7.3	**3**	**5**
8	**MENSURATION (Surface area & volume of pyramid):** 8.1 Define pyramid. 8.2 Explain the formula for areas of curved surfaces of pyramid. Explain the formula for volumes of pyramid. 8.3 Solve problems related to 8.2, 8.3	**2**	**4**
9	**MENSURATION (Surface area & volume of cone and sphere):** 9.1 Define cone and sphere. 9.2 Explain the formula for areas of curved surfaces of cone and sphere. 9.3 Explain the formula for volumes of cone and sphere. 9.4 Solve problems related to 9.2, 9.3	**3**	**5**
10	**GEOMETRY:** **Conic or conic sections:** 1.1 Define Conic, Focus, Directorix and Eccentricity. 1.2 Find the equations of Parabola, Ellipse and Hyperbola. 1.3 Solve problems related to Parabola, Ellipse and Hyperbola.	**3**	**5**
11	**CALCULAS (Differential Equations of first order and first degree):** 11.1 Define differential equation, ordinary & partial differential equation.	**4**	**7**

Unit	Topics with Contents	Class (1 Period)	Final Marks
	11.2 Define order and degree of differential equation. 11.3 Solve the differential equations of the form: Variable separable.		
12	**CALCULAS (Differential Equations of first order and first degree of homogeneous equations):** 12.1 Define Homogeneous equation & Homogeneous differential equation. 12.2 Define order and degree of differential equation. 12.3 Solve the differential equations of the form: Homogeneous equation.	**3**	**5**
13	**CALCULAS (First order and first degree of Exact differential equations):** 13.1 Define Exact differential equation. 13.2 Define integrating factor. 13.3 Solve problems related to Exact differential equations.	**3**	**5**
14	**CALCULAS (First order and first degree of Linear differential equations):** 14.1 Define Linear differential equation. 14.2 Define integrating factor, Bernoulli's equation. 14.3 Solve problems related to Linear differential equations.	**4**	**8**
15	**CALCULAS (Laplace Transformation):** 15.1 Define Laplace transformation in the form $F(S) = \int_0^{\infty} f(t)e^{-st}dt$ 15.2 Express the deduction of Laplace transformation of the following functions. (i) Constant (ii) t (iii) t^n (iv) e^{at} (v) sinat (vi) Cosat (vii) e^{at} t^n (viii) e^{at} sinbt (ix) e^{at} cosbt 15.3 Define inverse Laplace transformation 15.4 Solve problem related to 15.1, 15.2, 15.3	**4**	**8**
	Total	**48**	**90**

N.B. Marks allotted per chapter above may be rearranged if necessary.

Detailed Syllabus (Practical)

SL	Experiment name with procedure	Class (3 Period)	Continuous Marks
01	Find out the area of triangle	1	2
02	Find out the areas of quadrilateral, parallelogram, rhombus & trapezium	2	3
03	Calculate the areas of regular polygon	1	2
04	Calculate the areas of circle, sector and segment	2	3
05	Find out the area & volume of a rectangular solid	1	2
06	Calculate the surface area & volume of a prism	2	3
07	Find out the area & volume of cylinder	1	2
08	Calculate the surface area & volume of pyramid	2	2
09	Find out the surface area & volume of cone and sphere	1	2
10	Solve the problems related to conic sections & differential equation	3	4

SL	Experiment name with procedure	Class (3 Period)	Continuous Marks
01	Find out the area of triangle	1	2
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05	Find out the area & volume of a rectangular solid	1	2
06	Calculate the surface area & volume of a prism	2	3
07	Find out the area & volume of cylinder	1	2
08	Calculate the surface area & volume of pyramid	2	2
09	Find out the surface area & volume of cone and sphere	1	2
10	Solve the problems related to conic sections & differential equation	3	4
	Total	**16**	**25**

N.B. Marks allotted per chapter above may be rearranged if necessary.

Necessary Resources (Tools, equipment's and Machinery):

SL	Item Name	Quantity
01	Scale	1 no
02	Geometric Box	1 no

Recommended Books:

Sl	Book Name	Writer Name	Publisher Name & Edition
1.	Companion to basic Maths	G. V. Kumbhojkar	Phadke Prakashan
2.	Co-ordinate Geometry & Vector Analysis	Rahman & Bhattacharjee	H.L. Bhattacharjee
3.	Higher Mathematics	Md. Nurul Islam	Akkhar Patra Prakashani
4.	Mathematics for Polytechnic Students	S. P Deshpande	Pune Vidyarthi Graha Prakashan
5.	Mathematics for Polytechnic Students (Volume I)	H. K. Das	S.Chand Prakashan
6.	Engg.Maths Vol I & II	Shri Shantinarayan	S.Chand & Comp
7.	Higher Mathematics	Dr. B M Ekramul Haque	Akshar Patra Prakashani
8.	Differential & Integral Calculus	Md. Abu Yousuf	Mamun Brothers

Website References:

SL	Web Link: www.youtube.com	Remarks

Subject Code	Subject Name	Period per Week		Credit
26331	Chemical Engineering Operation-I	T	P	C
		2	3	3

Rationale	Bangladesh is a developing country. Day by day industrialization is growing fast. Chemical process industries are very much essential for developing country. Due to this reason Chemical engineering is an emerging technology not only in Bangladesh but all over the world. Modern and sophisticate chemical processing industries depending on dynamic chemical engineers for sustainability, health & safety issue and also safe environmental issue. Skill and knowledge of chemical engineering are the pre-requisite to meet the demand of existing and upcoming chemical process industries. So that Chemical Engineering Operation-I subject is introduced in the curriculum for Diploma in Chemical Engineering Course. The subject will enable the diploma engineers to define chemical engineering; interpret unit operation and unit process; identify fluid and their properties; friction in pipe; solving problem of different types of subject related equation; measure the fluid flow and pressure; illustrate pump and compressor.
Learning Outcome (Theoretical)	**AFTER UNDERGOING THE SUBJECT, STUDENTS WILL BE ABLE TO:** ▪ Interpret Chemical Engineering ▪ Illustrate basic concepts of fluid and their properties. ▪ Describe the basic concepts of flow of fluids through pipes. ▪ State operation and maintenance of flow measuring and pressure measuring instrument. ▪ Solve the problems related to equation of continuity, and Bernoulli's theorem, surface tension and viscosity of fluids, friction losses in pipes and fittings, pressure and pressure measurement, flow measurement by an orifice meter, venture meter and rotameter, problems of centrifugal and reciprocating pump ▪ State pump, compressor and conveyor.
Learning Outcome (Practical)	**AFTER UNDERGOING THE SUBJECT, STUDENTS WILL BE ABLE TO:** ▪ Identify and use of different types of pressure measuring equipment. ▪ Isolate different types of pipe and pipe fittings used in chemical industry. ▪ Identify and use of different types of flow measuring equipment. ▪ Calculate head loss/friction loss of flowing fluid. ▪ Identify and uses of temperature measuring equipment. ▪ Identify different parts of centrifugal and rotary pump.

Detailed Syllabus (Theory)

Unit	Topics with Contents	Class(1 Period)	Final Marks
1	**BASIC CONCEPT OF CHEMICAL ENGINEERING.** 1.1 Define chemical engineering. 1.2 Describe unit operations and unit processes. 1.3 List the name of important unit operations and processes. 1.4 Mention the importance of unit operations in process industries.	1	3
2	**FLOW OF FLUID** 2.1 Define flow of fluid. 2.2 Mention the different types of fluids. 2.3 List the properties of fluid. 2.4 Explain different types of flow. 2.5 Explain Reynold's number. 2.6 Explain discharge. 2.7 State the equation of continuity of flow. 2.8 State head, total head, pressure head, velocity head and static head of fluid 2.9 Express Bernoulli's theory and derivation of Bernoulli's equation. 2.10 Solve the problems related to equation of continuity, and Bernoulli's theorem.	3	6
3	**COMPRESSIBILITY, SURFACE TENSION AND VISCOSITY OF FLUIDS.** 3.1 Define compressible and incompressible fluids. 3.2 Define density, specific gravity, specific weight, surface tension, compressibility and viscosity. 3.3 Explain the surface tension for different types of liquids. 3.4 Derive the equation of surface tension. 3.5 Describe the absolute viscosity, gravitational viscosity and kinematic viscosity of fluids. 3.6 Establish the relations between absolute viscosity, gravitational viscosity and kinematic viscosity of fluids. 3.7 Solve the problems on surface tension and viscosity of fluids.	3	6
4	**THE FRICTION IN PIPES FOR INCOMPRESSIBLE FLUID.** 4.1 Define friction of fluid and head loss of flowing fluid. 4.2 Define frictional head loss. 4.3 State different types of friction losses. 4.4 Explain loss of head due to obstruction. 4.5 Explain loss of head due to bend and elbows. 4.6 Explain the various friction losses for flowing incompressible fluid in pipe and pipe fitting. 4.7 Deduce the equation of head loss due to sudden enlargement 4.8 Deduce the equation of head loss due to sudden contraction. 4.9 Solve problems with different types of friction losses in pipe and fitting.	3	6
5	**THE MEASUREMENT OF FLUID PRESSURE.** 5.1 Define pressure and intensity of pressure. 5.2 Mention the properties of intensity of pressure. 5.3 State free surface of liquid, atmospheric pressure, gauge pressure, vacuum pressure and absolute pressure. 5.4 Explain the intensity of pressure and pressure head in a vessel filled with fluids. 5.5 Explain side pressure, average side pressure and total side pressure	4	8

	of fluid in vessel. 5.6 List the fluid pressure measuring devices including microchip based instrument. 5.7 Explain the measurement of pressure and pressure difference by piezo meter, simple U-tube manometer, differential U-tube manometer, inclined tube manometer and inverted tube manometer. 5.8 Solve the problems related to pressure and pressure measurement.		
6	**THE FLOW AND FLOW MEASURING DEVICES.** 6.1 Define rate of flow and total flow of fluid. 6.2 List the name of flow measuring devices. 6.3 Describe the construction and working principle of orifice meter. 6.4 Describe the construction and working principle of venture meter. 6.5 Describe the construction and working principle of Rota meter. 6.6 Solve the problems related the flow measurement by an orifice meter and venture meter.	**4**	**6**
7	**THE PUMPING OF FLUIDS.** 7.1 Define pump. 7.2 List different types of pump. 7.3 List the considering factors to select a pump for a particular operation. 7.4 State pump head. 7.5 Explain different types of pump heads. 7.6 Describe series and parallel operation of pumps. 7.7 Define multistage centrifugal Pump. 7.8 Explain the back-flow of centrifugal pump.	**3**	**6**
8	**THE FEATURES OF CENTRIFUGAL PUMPS.** 8.1 Define centrifugal force and centrifugal pump. 8.2 Mention the construction (major parts of a pump) and operating principle of centrifugal pumps. 8.3 Define priming, self-priming, cavitation and vortex breaker. 8.4 Classify centrifugal pumps. 8.5 Mention the applications of centrifugal pumps. 8.6 Explain the special type pumps like as submersible pump, booster pump, and ejector pump. 8.7 Solve problems on centrifugal pumps. 8.8 Define compressor. 8.9 Classify compressor. 8.10 Mention the construction (major parts of a compressor) and operating principle of compressor.	**4**	**7**
9	**THE FEATURES OF RECIPROCATING AND ROTARY PUMP.** 9.1 Define reciprocating pump. 9.2 List the different types of reciprocating pump. 9.3 Explain single acting reciprocating pump and double acting reciprocating pump. 9.4 Illustrate the working principle of reciprocating pump. 9.5 Define rotary pump. 9.6 List the different types of rotary pump. 9.7 Mention the working principle of rotary pumps. 9.8 State screw pump, lobe pump and vane pump. 9.9 Describe the working principle and construction of gear pump 9.10 State the uses of reciprocating pump and rotary pump. 9.11 Solve the problems of reciprocating pump.	**4**	**6**

10	**THE TRANSPORTATION OF SOLIDS.** 10.1 Define conveyor. 10.2 Mention the different types of conveyors used in industries for transportation of solid. 10.3 Mention the construction and working principle of belt conveyor for transportation of solid. 10.4 Mention the construction and working principle of chain conveyor for transportation of solid. 10.5 Illustrate the working principles of elevators. 10.6 Describe the pneumatic conveying system.	**3**	**6**
	Total	**32**	**60**

Detailed Syllabus (Practical)

Sl. no.	Experiment name with procedure	Class (3 Period)	Continuous Marks
1.	**MEASURE THE PRESSURE OF AN INCOMPRESSEBLE FLUID FLOWING IN A PIPE USING OPEN U-TUBE MANOMETER.** 1.1 Collect Open U-tube manometer, mercury/carbon tetrachloride, Funnel. 1.2 Pour mercury/carbon tetrachloride in U-tube manometer using funnel up to datum line/ certain level. 1.3 Connect one side of U-tube manometer with air cock of pipe line. 1.4 Remove air from the tube connected with manometer. 1.5 Apply passing of fluid through the pipe line. 1.6 Take reading of (Hg) level of left side (h_1) and right side (h_2) of manometer. 1.7 Stop flow of fluid /turn off air cock. 1.8 Calculate Pressure using the equation, H = (h_2xs_2)- h_1xs_1)	**2**	**3**
2.	**MEASURE THE DIFFERENTIAL PRESSURE OF AN INCOMPRESSEBLE FLUID FLOWING IN A PIPE USING DIFFERENTIAL MANOMETER.** 2.1 Collect differential manometer, mercury/carbon tetrachloride, funnel and connect with two points of the pipe line where pressure difference is to be measured. 2.2 Apply Passing of fluid and remove air from both side of manometer. 2.3 Take readings of manometer over the datum line of manometer tube. 2.4 Stop the flow of fluid/turn off air cock. 2.5 Calculate the pressure difference between section A and B. P= (h_A - $h_{B)}$= (h_3s_3 + h_2s_2)- h_1s_1 s_1= Specific gravity of flowing fluid. s_2 = Specific gravity of manometric liquid. s_3 = Specific gravity of flowing fluid in right leg. 2.6 Submit the job report to class teacher.	**2**	**3**
3.	**MEASURE THE PRESSURE OF AN INCOMPRESSIBLE FLUID FLOWING IN A PIPE USING INCLINED TUBE MANOMETER.** 3.1 Collect inclined tube manometer, mercury/carbon tetra chloride funnel. 3.2 Pour manometer liquid in inclined tube manometer.	**1**	**2**

	3.3 Apply the pressure source in the vessel of inclined tube manometer. 3.4 Disconnect the manometer. 3.5 Maintain the records and of performed job. 3.6 Calculate the pressure difference using the formula: $P_2 - P_1 = \rho (1 + \frac{A_t}{A_w}) d \sin \propto$ 3.7 Submit the job report to your class teacher.		
4.	**MEASURE THE FLOW RATE OF A FLUID FLOWING THROUGH A PIPE USING ORIFICE METER.** 4.1 Collect differential U-tube manometer, manometer liquid (Hg/carbon tetra chloride) and a funnel. 4.2 Pour Manometer liquid in manometer tube. 4.3 Connect the tubes of manometer with up and down stream of orifice plate. 4.4 Apply the flow through the pipe line. 4.5 Observe, level of manometer liquid has gone down in up-stream of orifice and gone up in downstream side of orifice plate. 4.6 Calculate the flow rate using the formula, $Q = EA_0\sqrt{2gh}$ 4.7 Submit the job report to your class teacher.	**2**	**2**
5.	**MEASURE THE FLOW RATE OF A FLUID FLOWING THROUGH A PIPE USING VENTURI METER.** 5.1 Collect U-tube manometer, manometer liquid, and funnel. 5.2 Pour manometer liquid in differential manometer using funnel. 5.3 Connect manometer tube with the upstream and downstream side of venture meter. 5.4 Apply Passing of fluid through the venture tube and take reading of manometer. 5.5 Calculate the flow rate using the equation, $Q = C\frac{a_1 X a_2}{\sqrt{a_1^2 - a_2^2}}\sqrt{2gh}$ 5.6 Submit the report to your teacher.	**1**	**2**
6.	**MEASURE THE FLOW RATE OF A FLUID FLOWING THROUGH A PIPE LINE USING ROTA METER.** 6.1 Collect hydraulic bench. 6.2 Start the pump or open the inlet valve to allow flow of fluid through the Rota meter. 6.3 Mark the position of float in Rota meter tube. 6.4 Calculate the flow rate using the equation: $Q = KA_m\ 2_g\sqrt{\frac{V_f}{A_f}}(\frac{\rho_f}{\rho} - 1)$ Q= Flow rate, A_m=area between float and tube measured at the bottom of float. g= acceleration due to gravity, V_f=volume of float, $A_f = Area\ of float$, $\rho_f = density\ of\ float$, density of flowing fluid. 6.5 Submit the job report to the teacher.	**1**	**3**
7.	**DETERMINE THE HEAD LOSS DUE TO FRICTION IN A PIPE LINE.** 7.1 Collect platform balance, bucket, thermometer and a stopwatch. 7.2 Measure weight of empty bucket. 7.3 Apply steady state flow through the pipe and collect water in the bucket for about 20 seconds. 7.4 Measure weight and temperature of water. 7.5 Calculate mass rate of water. Find the density of water from the chart and calculate the flow rate (mass rate divided by density).	**2**	**2**

	7.6 Take at least 3 reading for the same flow and determine average flow rate and determine the velocity of water. 7.7 Calculate the friction loss using the equation: $h_f = \frac{4flv^2}{2gd}$ (Here h_f= Head loss due to friction, f=frictional co-efficient, l=length of the pipe, $\vartheta = velocity\ of$ water, g= acceleration due to gravity and d= diameter of pipe). 7.8 Submit the job report to the Teacher.		
8.	**MEASURE FRICTION LOSS/HEAD LOSS DUE TO SUDDEN ENLARGEMENT OF A PIPE.** 8.1 Collect platform balance, stop watch, bucket and thermometer. 8.2 Apply the flow of water through a pipe which is suddenly enlarged. 8.3 Collect water in the bucket for a steady state flow of water for about 20 to 25 seconds. Take weight of collected water in kilogram, measure temperature of water. 8.4 Calculate the average mass rate then flow rate. 8.5 Determine the velocity, v_1 at the point before enlarged and velocity, v_2 at the point after enlarged. 8.6 Calculate the head loss due to sudden enlargement: $h_e = \frac{(v_1 - v_2)^2}{2g}$ 8.7 Submit the practical report to the teacher.	**2**	**2**
9.	**MEASURE FRICTION LOSS/HEAD LOSS DUE TO SUDDEN CONTRACTION OF A PIPE LINE.** 8.1 Collect platform balance, bucket, thermometer and stop watch. 8.2 Measure weight of empty bucket. 8.3 Apply the steady state water flow through a pipe which is suddenly contracted. 8.4 Collect water in the bucket for 20 to 25 second and find the weight of water. Calculate mass rate of water. 8.5 Repeat the process for three times and calculate the average mass rate. Measure the temperature of water and determine the density of water from specific gravity chart. 8.6 Determine the flow rate (mass rate divided by density). 8.7 Determine the velocity of water in a point after contracted the pipe. 8.8 Calculate the head loss due to contraction using the formula: $h_c = \frac{kv^2}{2g}$ Where, $h_{c=}$ head loss due to sudden contraction. k=co-efficient of contraction. v= velocity of water in any point of contracted pipe. g= acceleration due to gravity. 8.9 Submit the practical report to the class teacher.	**1**	**3**
10.	**IDENTIFY CENTRIFUGAL AND ROTARY PUMP DISASSEMBLE, CLEANING AND REASSEMBLE.** 10.1 Select centrifugal and rotary pump. 10.2 Put centrifugal pump and rotary pump on the working table. 10.3 Mark major parts of pump. 10.4 Clean all the parts including casing. 10.5 Identify the impeller, rotor, shaft and key. 10.6 Reassemble and connect with motor. 10.7 Submit the performed job to the teacher.	**2**	**3**
	Total	**16**	**25**

Necessary Resources (Tools, equipment's and Machinery):

Sl	Item Name	Quantity
01	Tools and materials: Ball pin hammer, standard screw driver, two ended dull wrench, hack saw, punch machine (heavy duty), scissors, measuring tape, foot rule, funnel, gland rope, labeler, flange, gasket, air cock, capillary tube, pipe and pipe fittings. Manometer liquid (mercury/carbon tetrachloride)	1 set
02	Pump: Centrifugal pump with shaft, impeller, pump motor. Rotary pump with shaft and rotor, pump motor.	1 set
03	U-tube manometer, differential manometer, inclined tube manometer, orifice meter, venture meter, Rota meter.	1 set
04	Mercury thermometer	1 set
05	Pressure gauge	1 set

Recommended Books:

Sl	Book Name	Writer Name	Publisher Name & Edition
01	Unit Operations of Chemical Engineering.	W.l. Mc Cabe and J.C Smith	
02	Introduction to Chemical Engineering	- Badger and Banchero	
03	Chemical Engineering I & II (3rd edition	- J. M. Coulson and J. F. Richardson	
04	Chemical Engineering Hand Book	- Perry	
05	An Introduction Chemical Engineering	- C. E. Littejohn and G. F. Meenaghan	
06	Unit operations of chemical engineering	- p. Chattopadhyay.	
07	Centrifugal Pumps and Blowers	Austin W. Church and Jagodish Lal	
08	হাইড্রলিক্স এন্ড হাইড্রলিক মেশিনারি	বাংলাদেশ কারিগরি শিক্ষা বোর্ড, ঢাকা।	বাংলাদেশ কারিগরি শিক্ষা বোর্ড, ঢাকা।
09	Instrumentation	KIRK AND RIMBOI	B. B. Taraporevala SONS & Co.Private ltd. Published by arrangement with Americal technical society.

Website References:

Sl	Web Link	Remarks
01	https://www.amazon.com/Unit-Operations-Chemical-Engineering-McGraw/dp/0072848235	
02	https://www.goodreads.com/book/show/2207547.Introduction_To_Chemical_Engineering	
03	https://www.amazon.com/Introduction-Chemical-Engineering-Meenaghan-Littlejohn/dp/B002TOWC9W	
04	https://www.amazon.com/Coulson-RichardsonS-Chemical-Engineering-3rd/dp/8131204529	
05	https://chembugs.files.wordpress.com/2015/12/perrys-chemical-engineering-handbook1.pdf	
06	https://books.google.com.bd/books/about/Unit_Operations_of_Chemical_Engineering.html?id=8UbOjwEACAAJ&redir_esc=y	
07	http://centrifugalpumpskushisoku.blogspot.com/2017/03/centrifugal-pumps-and-blowers-church-pdf.html	

Subject Code	Subject Name	Period per Week		Credit
26332	Industrial Chemistry	T	P	C
		2	3	3

Rationale	Day by day Industrialization is growing fast. Chemical process industries are very much essential for developing country. Due to this reason Chemical engineering is an emerging technology not only in Bangladesh but all over the world. Modern and sophisticate chemical processing industries depending on dynamic chemical engineers for sustainability, health & safety issue and also safe environmental issue. Skill and knowledge of chemical engineering are the pre-requisite to meet the demand of existing and upcoming chemical process industries. So that Industrial Chemistry subject is introduced in the curriculum for Diploma in Chemical Engineering Course. The subject is uses chemical and physical processes to transform raw materials into products that are beneficial to mankind. This includes chemical reaction, oxidation, reductions; Classification of organic compounds; Saturated and unsaturated hydrocarbons; Alcohols; Aldehydes and ketons; Formaldehyde; Aromatic compound and nitro benzene.
Learning Outcome (Theoretical)	**AFTER UNDERGOING THE SUBJECT, STUDENTS WILL BE ABLE TO:** ▪ Interpret Quantum Numbers ▪ Describe **oxidation-reduction titration and iodimetry & iodometry** ▪ Interpret **organic compounds** ▪ State the **saturated and unsaturated hydrocarbon** ▪ **Comprehend alcohols** ▪ State **aldehyde and ketone** ▪ **Interpret the fatty acid and its derivatives** ▪ **State acetic acid** ▪ **Interpret Aromatic compounds** ▪ **Explain feature of carbohydrate** ▪ **Describe bio-molecular chemistry**
Learning Outcome (Practical)	**AFTER UNDERGOING THE SUBJECT, STUDENTS WILL BE ABLE TO:** • Prepare N/10 solution of Sodium Hydroxide (NaOH) & Potassium Hydroxide (KOH) • Prepare N solution of Sulfuric acid (H_2SO_4) and Hydrochloric acid (HCl) • Standardize the Sodium Hydroxide using standard oxalic acid • Identify the presence of Hydrogen and Carbon in organic compounds • Determine the purity of organic compound by solvent extraction methods • Identify the free fatty acid (FFA) of edible oil (soya bean oil) • Perform the Isocyanides test, Reduction test and Nessler reagent test for chloroform. • Perform the flashing point test of ethyl alcohol. • Prepare formic acid from oxalic acid. • Identify unknown organic substances by physical characteristics. • Prepare nitrobenzene from benzene • Identify aldehydes by Tolen-reagent test.

Detailed Syllabus (Theory)

Unit	Topics with Contents	Class (1 Period)	Final Marks
1	**QUANTUM NUMBERS** 1.1 Define quantum number. 1.2 List the four quantum numbers 1.3 Describe quantum numbers. 1.4 Mention the significance of quantum numbers. 1.5 Explain energy levels, shells and sub-shells. 1.6 Differentiate between orbit and orbital. 1.7 State Atomic number, Gram atom, Molecular mass and Atomic mass number. 1.8 Show the distribution of electrons: Li_3, Be_4, N_7, Ne_{10}, Na_{11}, S_{16}, Cl_{17}, K_{19}, Ca_{20}, Fe_{26}, C_{u29}, and Zn_{30}.	3	5
2	**OXIDATION-REDUCTION TITRATION AND IODIMETRY & IODOMETRY** 2.1 Define titration. 2.2 Explain indicators 2.3 Mention ten chemical indicators. 2.4 Explain iodimetry and iodometry. 2.5 Explain the manufacturing process of starch solution. 2.6 State Standardization procedure of thiosulphate solution by standard $K_2Cr_2O_7$ solution by iodimatric methods. 2.7 Explain preparation procedure of standard 0.1N iodine solution.	3	5
3	**ORGANIC COMPOUNDS** 3.1 State organic compounds. 3.2 Describe the classification of organic compounds. 3.3 Explain the functional group of organic compounds. 3.4 Define Alkanes, Alkenes and Alkynes 3.5 Describe the properties of hydrocarbon 3.6 Describe the preparation of Ethylene 3.7 Explain hydrocarbon, saturated hydrocarbon and unsaturated hydrocarbon 3.8 Describe the properties of saturated hydrocarbon 3.9 Explain Physical and chemical properties of Methane and Ethane	2	5
4	**ALCOHOLS** 4.1 State alcohols. 4.2 Explain the functional group of alcohols. 4.3 Mention the classification of alcohols. 4.4 Mention the structure formula of four alcohols. 4.5 Explain the primary, secondary and tertiary alcohols. 4.6 Explain the manufacturing of ethyl alcohols. 4.7 Explain the manufacturing process of ethyl alcohols from starch by fermentation. 4.8 Explain Fermentation, Methylated spirit, Rectified spirit, Power alcohol, Enzyme and Saponification. 4.9 Mention the uses of alcohols.	3	5
5	**ALDEHYDE AND KETONE** 5.1 Define aldehyde and ketone. 5.2 State the functional radical of aldehyde and ketone. 5.3 Explain the preparation of formaldehyde. 5.4 Mention the properties of formaldehyde. 5.5 Mention the uses of formaldehyde. 5.6 State the meaning of formalin and its uses.	2	5
6	**FATTY ACID** 6.1 Define fatty acid.	2	4

	6.2 Mention the types of fatty acid. 6.3 Mention the chemical formula of five fatty acids. 6.4 State the derivatives of fatty acids. 6.5 Explain esterification. 6.6 State formic acid. 6.7 Describe the uses of formic acid.		
7	**ACETIC ACID** 7.1 Explain the industrial manufacturing of acetic acid. 7.2 Mention the physical and chemical properties of acetic acid. 7.3 Mention the uses of acetic acid. 7.4 Explain the preparation of ethyl acetate. 7.5 Mention the properties of ethyl acetate. 7.6 Mention the uses of ethyl acetate.	**3**	**5**
8	**AROMATIC COMPOUNDS** 8.1 State aromatic compounds. 8.2 List the compounds of aromatic. 8.3 Differentiate between aliphatic and aromatic compounds 8.4 Explain the preparation of benzene. 8.5 Mention the uses of benzene. 8.6 Explain the preparation of toluene. 8.7 Mention the uses of toluene. 8.8 Explain the preparation of 2-4-6 Tri-nitro toluene (TNT). 8.9 Mention the uses of TNT (Tri-nitro toluene).	**3**	**6**
9	**CARBOHYDRATE** 9.1 Explain carbohydrates. 9.2 Mention the classification of carbohydrates. 9.3 Explain the preparation of glucose. 9.4 Mention the physical and chemical properties of glucose. 9.5 List the uses of glucose. 9.6 State sucrose. 9.7 Mention the properties of sucrose.	**2**	**5**
10	**BIO-MOLECULAR CHEMISTRY** 10.1 Define isomerism and optical isomer. 10.2 State reducing and non-reducing sugar 10.3 Explain cellulose. 10.4 Mention the uses of cellulose. 10.5 Explain protein and composition of protein. 10.6 Describe the classification of protein. 10.7 Explain enzyme and enzyme inhibitor. 10.8 Describe nucleic acid. 10.9 Mention the classification of nucleic acid	**3**	**5**
	Total	**32**	**60**

Detailed Syllabus (Practical)

Sl.	Experiment name with procedure	Class (3 Period)	Continuous Marks
1	**Prepare N/10 solution of Sodium Hydroxide (NaOH) & Potassium Hydroxide (KOH)** 1.1 Follow Occupational Safety and Health (OSH) 1.2 Select and Collect and Ware Personal Protective Equipment (PPE) 1.3 Select and Collect Required Tools and Equipment	**2**	**3**

	1.4 Follow Instruction sheet / Job sheet 1.5 Calculate the equivalent weight and find out the required amount to make N/10 NaOH 1.6 Dissolve in deionized or distilled water 1.7 Adjust the volume with deionized or distilled water 1.8 Storage in room temperature 1.9 Clean and Store tools and Equipment as required 1.10 Maintain the record of performed task.		
2	**Prepare N solution of Sulphuric Acid (H_2SO_4) and Hydrochloric Acid (HCl)** 2.1 Follow Occupational Safety and Health (OSH) 2.2 Select and Collect and Ware Personal Protective Equipment (PPE) 2.3 Select and Collect Required Tools and Equipment 2.4 Follow Instruction sheet / Job sheet 2.5 Calculate the equivalent weight and find out the required amount to make 1N **H_2SO_4** 2.6 Mix in deionized or distilled water carefully 2.7 Adjust the volume with deionized or distilled water 2.8 Storage in room temperature 2.9 Clean and Store tools and Equipment as required 2.10 Maintain the record of performed task.	**2**	**3**
3	**Standardize the sodium hydroxide using standard oxalic acid** 3.1 Follow Occupational Safety and Health (OSH) 3.2 Select, Collect and Ware Personal Protective Equipment (PPE) 3.3 Select and Collect Required Tools and Equipment 3.4 Follow Instruction sheet / Job sheet 3.5 Make titration 3.6 Fill the table and calculate the result 3.7 Clean and Store tools and Equipment as required 3.8 Maintain the record of performed task.	**1**	**3**
4	**Detect the presence of hydrogen and carbon in organic compounds** 4.1 Follow Occupational Safety and Health (OSH) 4.2 Select, Collect and Ware Personal Protective Equipment (PPE) 4.3 Select and Collect Required Tools and Equipment 4.4 Follow Instruction sheet / Job sheet 4.5 Select and Collect test tube, discharge tube with bulb, Bunsen burner, Stand, $Ca(OH)_2$ and sample (organic compound). 4.6 Perform presence of Carbon and Hydrogen of supplied sample 4.7 Store Cleaning equipment and chemicals in the designated area in accordance with workplace requirements 4.8 Maintain the record of performed job 4.9 Submit report of performed job to the teacher	**2**	**3**
5	**Determine the purity of organic compound by solvent extraction methods** 5.1 Follow Occupational Safety and Health (OSH) 5.2 Select, Collect and Ware Personal Protective Equipment (PPE) 5.3 Select and Collect Required Tools and Equipment 5.4 Follow Instruction sheet / Job sheet	**2**	**3**

	5.5 Select and collect separating funnel, soxhlet extractor, ether, chloroform & ethyl alcohol 5.6 Perform purification of supplied sample 5.7 Store Cleaning equipment and chemicals in the designated area in accordance with workplace requirements 5.8 Maintain the record of performed task.		
6	**Identify the free fatty acid (FFA) of edible oil (soya been oil)** 6.1 Select, Collect and Ware Personal Protective Equipment (PPE) 6.2 Select and Collect Required Tools and Equipment 6.3 Follow Instruction sheet / Job sheet 6.4 Collect soya been oil, standard alkali solution 6.5 Make titration the soya been oil by standard alkali 6.6 Calculate the %FFA 6.7 Record the data 6.8 Clean and Store tools and Equipment as required 6.9 Maintain the record of performed task.	**1**	**2**
7	**Perform the isocyanides test, reduction test and Nessler's reagent test for chloroform.** 7.1 Select and collect PPE and wear PPE. 7.2 Select and collect related equipment, tools and chloroform, Aniline, Potassium Hydroxide, Zinc, HCl, KI and $HgCl_2$. 7.3 Perform isocyanides test, reduction test and Nessler's reagent test for chloroform. 7.4 Store Cleaning equipment and chemicals in the designated area in accordance with workplace requirements. 7.5 Maintain the record of performed job.	**1**	**2**
8	**Perform the flashing test of ethyl alcohol.** 8.1 Select and collect PPE and wear PPE. 8.2 Select and collect related equipment and chemicals. 8.3 Perform flashing test. 8.4 Store Cleaning equipment and chemicals in the designated area in accordance with workplace requirements. 8.5 Maintain the record of performed job.	**1**	**2**
9	**Prepare formic acid from oxalic acid.** 9.1 Select and collect PPE and wear PPE. 9.2 Select and collect related equipment and chemicals. 9.3 Perform preparation of formic acid from oxalic acid. 9.4 Store Cleaning equipment and chemicals in the designated area in accordance with workplace requirements. 9.5 Maintain the record of performed job.	**1**	**2**
10	**Prepare nitrobenzene from benzene** 10.1 Select and collect PPE and wear PPE. 10.2 Select and collect related equipment and chemicals. 10.3 Perform preparation of citric acid from lemon juice. 10.4 Store Cleaning equipment and chemicals in the designated area in accordance with workplace requirements. 10.5 Maintain the record of performed job.	**1**	**2**
	Total	**14**	**25**

Necessary Resources (Tools, equipment's and Machinery):

Sl.	Items	Item Name	Quantity
01	Tools and equipment	Weighing scale, Water bath, Burette stand, Gas cylinder, Bunsen burner, thermometer,	5 nos
02	Glass ware	Soxhlet extractor, Separating funnel, Test tube, discharge tube with bulb, Burette, Pipette, conical flask, capillary tube,	5 nos
03	Reagent and Chemical	Ether, chloroform, ethyl alcohol. $Ca(OH)_2$, chloroform, Aniline, Potassium Hydroxide, Zinc, HCl, KI, $HgCl_2$, ethyl alcohol, oxalic acid, Formaldehyde (methanol), Acetaldehyde (ethanol), carbohydrates, fats (lipids), proteins, nucleic acids, benzene, Tolen-reagent, Benzene, Citric Acid, Formic Acid.	As per requirement

Recommended Books:

Sl	Book Name	Writer Name	Publisher Name & Edition
01	General chemistry (Bangla)	Md. Rafiqul Islam	
02	Organic chemistry (Bangla)	Md. Nurul Haque Mia	
03	Practical chemistry (Honours)	Md. Nurul Haque Mia Mohir Uddin	
04	Industrial Chemistry(Bangla)	Dr. Rokeya Begum Mir Abdul Haque Md. Abdus Sattar	Haque Publication,Banglabaza, Dhaka
05	Chemistry (First Paper) Class: XI-XII	Dr. Shoroj Kanti Singh Hazari, Prof. Haradhan Nag	Hasan Book House,Dhaka,Bangladesh
06	Chemistry(Second Paper) Class: XI-XII	Dr. Shoroj Kanti Singh Hazari, Prof. Haradhan Nag	Hasan Book House,Dhaka,Bangladesh
07	Industrial Chemistry	B. K. Sharma	Geol Publishing Hous
08	Riegel's Hand Book of Industrial Chemistry	J. A. Kent edited, Van Nostrand	Springer; 9th edition (February 4, 1993)
09	Understanding chemistry part- III	Ted Lister & Jenet Renshow	Oxford University Press; 3rd edition (November 1, 2014)
10	আধুনিক শিল্প রসায়ন-	প্রফেসর মোঃ মহির উদ্দিন।	আধুনিক শিল্প রসায়ন-
11	শিল্প রসায়ন	শিল্প রসায়ন এস. এ. কিউ. এম. হারুন, এবং মু. সায়দুল ইসলাম।	শিল্প রসায়ন
12	শিল্প রসায়ন ও রাসায়নিক প্রযুক্তি	ডাঃ এ এস এম নূরুল হক ভূইয়া।	শিল্প রসায়ন ও রাসায়নিক প্রযুক্তি
13	Higher Secondary Practical Chemistry(First& Second Paper)	Dr. Md. Mominul Haque Dr. Gazi Md. Ahsanul Haque Kabir Dr. Md. Robiul Islam	Ashrafia Boighar,Dhaka

Website References:

Sl	Web Link	Remarks
01	https://www.flipkart.com/industrial-chemistry-vol-i-vol-ii/p/itm342607d205225	
02	https://www.pdfdrive.com/kent-and-riegels-handbook-of-industrial-chemistry-and-biotechnology-e185064069.html	
03	https://www.amazon.com/Understanding-Chemistry-Advanced-Level-Third/dp/0748739580	

Subject Code	Subject Name	Period per Week		Credit
26333	Chemical Engineering Materials	T	P	C
		2	3	3

Rationale	Bangladesh is a middle-income country. Industrialization is growing fast. Chemical process industries are very much essential for developing country. Due to this reason Chemical engineering is an emerging technology not only in Bangladesh but all over the world. Modern and sophisticate chemical processing industries depending on dynamic chemical engineers for sustainability, health & safety issue and also safe environmental issue. Skill and knowledge of chemical engineering are the pre-requisite to meet the demand of existing and upcoming chemical process industries. So that chemical Chemical Engineering Materials subject is introduced in the curriculum for Diploma in Chemical Engineering Course. The subject will enable the diploma engineers to know chemical engineering materials, stone and tiles, brick, sand and clay, lime and cement, glass and ceramics, pigment, paints and varnishes, insulating materials, fire and waterproofing materials, plastic materials.
Learning Outcome (Theoretical)	**AFTER UNDERGOING THE SUBJECT, STUDENTS WILL BE ABLE TO:** ▪ Explain chemical engineering materials. ▪ Describe stone and tiles. ▪ State brick. ▪ Explain sand and clay ▪ State lime and cement. ▪ Discuss glass and ceramics. ▪ Describe pigment, paints and varnishes. ▪ State insulating materials. ▪ Explain fire and water proofing materials. ▪ Describe plastic and plastic materials.
Learning Outcome (Practical)	**AFTER UNDERGOING THE SUBJECT, STUDENTS WILL BE ABLE TO:** ▪ Identify various types of stone and tiles. ▪ Perform field test of bricks. ▪ Perform lab test of bricks. ▪ Perform test of sand. ▪ Identify physical properties of different types of clay. ▪ Perform test of lime. ▪ Perform physical test of cement. ▪ Perform field test of paint. ▪ Identify fire and water proof materials. ▪ Identify different types of plastic materials.

Detailed Syllabus (Theory)

Unit	Topics with Contents	Class (1 Period)	Final Marks
1	**CHEMICAL ENGINEERING MATERIALS** 1.1 Define chemical engineering materials 1.2 List the chemical engineering materials. 1.3 Mention the classification of chemical engineering materials. 1.4 List the characteristics of chemical engineering materials. 1.5 Explain the importance of chemical engineering materials.	**2**	**6**
2	**STONE AND TILES** 2.1 Define stone and tiles. 2.2 Mention the physical and chemical classification of stones. 2.3 Mention the Composition of stone. 2.4 List the characteristics of good stones. 2.5 Describe the dressing of stones. 2.6 State clay tile, Homogeneous tiles, polished tiles, glazed tiles, marble tiles cement tiles and Mosaic. 2.7 Describe the uses of stone and tiles in engineering field.	**4**	**6**
3	**BRICK** 3.1 Define brick. 3.2 Mention constituents of a good brick. 3.3 Classify bricks. 3.4 Mention the ingredients and application of fired brick 3.5 Explain the table molding and machine molding. 3.6 Describe the drying processes of brick. 3.7 State the burning processes of brick. 3.8 Define Special Bricks, Hollow Block and Ceramic brick. 3.9 Describe manufacturing process of block brick 3.10Mention the uses of Hollow Block and Ceramic brick.	**2**	**6**
4	**SAND AND CLAY** 4.1 Define sand and clay 4.2 Mention the composition of sand. 4.3 Mention the classification of sand based on their sources. 4.4 Mention the specification and application of sand 4.5 Describe the purpose of grading of sand. 4.6 Mention the uses of various grades of sand. 4.7 State different types of clay 4.8 Write the properties of clay 4.9 Mention the uses of clay	**2**	**6**
5	**LIME AND CEMENT** 5.1 Define lime, Calcination, Hydraulicity and Quick lime. 5.2 Describe the Classification of lime. 5.3 Mention the properties of lime. 5.4 Explain the manufacturing process of lime. 5.5 State the uses of different kinds of lime. 5.6 Describe the storage of lime. 5.7 Define cement 5.8 Mention the functions of various ingredients of cement. 5.9 Mention the uses of cement as chemical engineering material.	**2**	**6**

6	**GLASS AND CERAMICS.** 6.1 Define glass and ceramic. 6.2 Mention the constituents of glass. 6.3 List the properties of glass. 6.4 State the classification of glass. 6.5 Mention the uses of glass. 6.6 Mention the constituents of ceramics. 6.7 Describe the properties of ceramics. 6.8 Mention the classification of ceramics. 6.9 Describe the uses of ceramics in engineering field.	**4**	**6**
7	**PIGMENT, PAINTS AND VARNISHES** 7.1 Define Pigment. 7.2 Explain the functions of pigment. 7.3 Define paint and varnish. 7.4 Explain the characteristics of paint. 7.5 List the essential constituents of paint. 7.6 List the main constituents of varnishes. 7.7 Explain the characteristics of varnish. 7.8 Describe synthetic materials used for paint and varnish.	**4**	**6**
8	**INSULATING MATERIALS** 8.1Mention the functions of insulating materials. 8.2 List natural heat insulating materials. 8.3 Mention the synthetic insulating materials. 8.4 Describe the sources of obtaining rubber, cork and ebonite. 8.5 Describe the properties and uses of asbestos as insulating materials. 8.6 List of sound absorbing materials.	**4**	**6**
9	**FIRE AND WATER PROOFING MATERIALS** 9.1 State fire proofing and water proofing materials. 9.2 List the fire proofing and water proofing materials. 9.2 State the importance of fire and water proof materials used in chemical industries. 9.3 Mention the uses of asbestos as fire and water proof materials. 9.4 List the characteristics of refractory materials. 9.5 Explain the uses of rubber as water proofing material.	**4**	**6**
10	**PLASTIC AND PLASTIC MATERIALS.** 10.1Define plastic. 10.2 List the plastic raw materials. 10.3 Mention different types of plastic. 10.4 State the properties of plastic. 10.5 Describe the molding methods of plastic products. 10.6 State the uses of plastic materials.	**4**	**6**
	Total	**32**	**60**

Detailed Syllabus (Practical)

Sl.	Experiment name with procedure	Class (3 Period)	Continuous Marks
1	**IDENTIFY VARIOUS TYPES OF STONE AND TILES** 1.1 Follow Occupational Safety and Health (OSH).	**1**	**2**

	1.2 Select, Collect, and Ware Personal Protective Equipment (PPE) 1.3 Select and Collect Required various types of stone and tiles. 1.4 Identify different types of stone and tiles on the basis of formation. 1.5 Clean the working area and Store materials as required. 1.6 Submit report of performed job to the teacher. 1.7 Maintain the record of performed task.		
2	**PERFORM FIELD TEST OF BRICKS** 2.1 Follow Occupational Safety and Health (OSH). 2.2 Select, Collect and Ware Personal Protective Equipment (PPE). 2.3 Select and Collect Required Tools and Equipment. 2.4 Perform field test of bricks as per required. 2.5 Maintain the record and submit it to the teacher. 2.6 Clean and Store tools and Equipment as required. 2.7 Maintain the record of performed task.	**1**	**2**
3	**PERFORM LAB TEST OF BRICKS** 3.1 Follow Occupational Safety and Health (OSH). 3.2 Select, Collect and Ware Personal Protective Equipment (PPE). 3.3 Select and Collect Required Tools and Equipment. 3.4 Perform lab test of bricks (Compression test, Absorption test and Average weight). 3.5 Maintain the record and submit it to the teacher. 3.6 Clean and Store tools and Equipment as required. 3.7 Maintain the record of performed task.	**1**	**3**
4	**PERFORM TEST OF SAND** 4.1 Follow Occupational Safety and Health (OSH). 4.2 Select, Collect and Ware Personal Protective Equipment (PPE). 4.3 Select and Collect Required Tools and Equipment. 4.4 Perform Bulking of sand, Fineness Modulus(FM) of sand, Moisture in silica sand. 4.5 Maintain the record and submit it to the teacher. 4.6 Clean and Store tools and Equipment as required. 4.7 Maintain the record of performed task.	**2**	**2**
5	**PERFORM TEST OF LIME** 5.1 Follow Occupational Safety and Health (OSH). 5.2 Select, Collect and Ware Personal Protective Equipment (PPE). 5.3 Select and Collect Required Tools and Equipment. 5.4 Perform Heat test of Lime. 5.5 Maintain the record and submit it to the teacher. 5.6 Clean and Store tools and Equipment as required. 5.7 Maintain the record of performed task.	**1**	**3**
6	**PERFORM PHYSICAL TEST OF CEMENT** 6.1 Follow Occupational Safety and Health (OSH). 6.2 Select, Collect and Ware Personal Protective Equipment (PPE). 6.3 Select and Collect Required Tools and Equipment. 6.4 Perform Physical test and FM test of cement. 6.5 Maintain the record and submit it to the teacher.	**2**	**3**

	6.6 Clean and Store tools and Equipment as required. 6.7 Maintain the record of performed task.		
7	**IDENTIFY PHYSICAL PROPERTIES OF DIFFERENT TYPES OF CLAY** 7.1 Select, Collect and Ware Personal Protective Equipment (PPE) 7.2 Select and Collect Required Tools and Equipment 7.3 Identify physical properties of china clay, ball clay, fire clay and Bijoypur clay. 7.4 Maintain the record and submit it to the teacher. 7.5 Clean and Store tools and Equipment as required. 7.6 Maintain the record of performed task.	**2**	**3**
8	**PERFORM FIELD TEST OF PAINT** 8.1 Follow Occupational Safety and Health (OSH). 8.2 Select, Collect and Ware Personal Protective Equipment (PPE). 8.3 Select and Collect Required Tools and Equipment. 8.4 Perform field test of paint as per required. 8.5 Maintain the record and submit it to the teacher. 8.6 Clean and Store tools and Equipment as required. 8.7 Maintain the record of performed task.	**2**	**3**
9	**IDENTIFY FIRE AND WATER PROOF MATERIALS** 9.1 Follow Occupational Safety and Health (OSH). 9.2 Select, Collect and Ware Personal Protective Equipment (PPE). 9.3 Select and Collect Required various types of fire and water proof materials. 9.4 Follow instruction sheet. 9.5 Identify different types of fire and water proof materials as per appearance, temperature range. 9.6 Maintain the record and submit it to the teacher. 9.7 Clean and Store tools and Equipment as required. 9.8 Maintain the record of performed task.	**2**	**2**
10	**IDENTIFY DIFFERENT TYPES OF PLASTIC MATERIALS** 10.1 Follow Occupational Safety and Health (OSH). 10.2 Select, Collect and Ware Personal Protective Equipment (PPE). 10.3 Select and Collect Required various types of plastic and plastic materials. 10.4 Follow instruction sheet. 10.5 Identify different plastic materials as per appearance, burning and density. 10.6 Maintain the record and submit it to the teacher. 10.7 Clean and Store tools and Equipment as required. 10.8 Maintain the record of performed task.	**2**	**2**
	Total	**16**	**25**

Necessary Resources (Materials, Tools, equipment and Machinery):

Sl	Item Name	Quantity
01	Stone, Bricks, Sand, Lime, Cement, Clay, paint, fire and water proof materials, plastic materials.	As per required.
02	Sieve	10

03	Weight machine	10
04	Crusher	2
05	Wood board	10
06	Paintbrush	20
07	White cotton pad	20
08	Dry cotton fabric pad	20
09	Cloth cover	20
10	Oven	2
11	Measuring tape	20
12	Scale	20
13	T-Square	20
14	Pencil and Pencil cutter	20
15	Eraser	20
16	Vibrator	2
17	Weir brush	20

Recommended Books:

Sl	Book Name	Writer Name	Publisher Name & Edition
01	A text book on Engineering Materials	- G. J. Kulkarni	
02	Engineering Materials	- Dr. M. A. Aziz	
03	Plastic Materials	- J. A Brydson	
04	A Text Book of Engineering Material	- Dr. M.A.Aziz	
05	Ceramic engineering materials 1 & 2		BTEB

Website References:

Sl	Web Link	Remarks
01	https://www.injectionmould.org/2019/04/02/plastic-material-identification/	
02	https://m.resene.co.nz/paint-testing.htm	

Subject Code	Subject Name	Period Per Week		
		T	P	C
26711	BASIC ELECTRICITY	3	3	4

Rationale	Diploma in Engineering Level students are required to acquire the knowledge and skill on concept of nature of electricity, electrical house wiring, Earthing and Electrical wiring tests. By the completion of this course student will be able to perform different types of joints and splices, Fittings of electrical installation works such as lamp circuit, Tube light circuit and Calling bell circuit. As such the knowledge of basic electricity the pre-requisite for these fields for effective discharge of their duties. These necessities the introduction of Electrical Engineering subject in the curriculum of Diploma in Engineering level. The subject covers only such topics which will enable the diploma engineers to identify and classify the different types of Hand tools used in electrical house wiring, Different types of switches, Lamps, Electrical Fittings and fixtures Conductor, Insulator, Semiconductor, Wires and cables, Joint and splices. They will be able to verify and apply Ohms law, Joules law, Series and Parallel circuit. Have been given more emphasis on practical aspect rather than theory in teaching learning approach.
Learning Outcome (Theoretical)	After Completing the subject, students will be able to: ▪ Classify various types Materials used in electrical works ▪ Describe Capacitance, Inductance and the Laws of resistance ▪ State the Ohms law and Joules law ▪ Describe Series, parallel and combined circuit ▪ Acquire the knowledge of joints and splices ▪ Achieve knowledge of Controlling and protective devices ▪ Acquaint the knowledge of House wiring
Learning Outcome (Practical)	After undergoing the subject, students will be able to: ▪ Identify various types hand tools and Materials used in electrical works ▪ Verify the Ohms law and Joules law ▪ Verify the characteristic of Series and parallel circuit ▪ Identify the types of wires and cables ▪ Perform different types of joints and splices ▪ Operate Controlling and protective devices ▪ Perform House wiring (Channel wiring)

Detailed Syllabus (Theory)

Unit	Topics with contents	Class (1 Period)	Final Marks
1.	**ELECTRICITY AND ITS NATURE** 1.1 State the meaning of electricity. 1.2 Describe the structure of atom. 1.3 Define current, voltage and resistance. 1.4 Mention units of current, voltage and resistance.	2	3
2	**CONDUCTOR, SEMI-CONDUCTOR AND INSULATOR.** 2.1 Define conductor, semiconductor and insulator. 2.2 Explain the conductor, semiconductor, and insulator according to electron theory. 2.3 List different types of conductors, semiconductors and insulators. 2.4 Describe the factors affecting the resistance of a conductor. 2.5 State laws of resistance. 2.6 Prove the relation, $R= \rho \frac{L}{A}$ 2.7 Explain the meaning of resistivity 2.8 Mention the unit of resistivity. 2.9 Solve problems relating to laws of resistance.	3	6
3	**CAPACITORS AND INDUCTORS.** 3.1 Define capacitor and capacitance. 3.2 Mention the unit of capacitance. 3.3 Name the different types of capacitors. 3.4 Define inductor and inductance. 3.5 Mention the unit of inductance 3.6 Classify the different types of inductors. 3.7 List the uses of capacitor and inductor. 3.8 Determine the equivalent capacitance of a number of capacitors connected in series and parallel. 3.9 Explain the energy storage in a capacitor. 3.10 Solve the problems relating to capacitors.	3	8
4	**OHM'S LAW & JOULE'S LAW** 4.1 State Ohm's law. 4.2 Explain the limitations of Ohm's law 4.3 Deduce the relation among current, voltage and resistance. 4.4 Solve problems relating to Ohm's law. 4.5 Describe the heating effect of electricity.	3	9

	4.6 Explain Joule's law regarding heat produce in electric circuit. 4.7 Describe mechanical equivalent of heat (J) 4.8 Solve problems relating to Joule's law.		
5	**ELECTRICAL CIRCUIT** **5.1** Define electric circuit. 5.2 State the elements of electric circuit 5.3 Classify electric circuits. 5.4 Define series circuit, parallel circuit and combined circuit. 5.5 Describe the characteristics of series circuit and parallel circuit. 5.6 Calculate the equivalent resistance of series circuit, parallel circuit and combined circuit. 5.7 Solve problems relating to series, parallel and combined circuit.	**6**	**10**
6	**ELECTRICAL POWER AND ENERGY** 6.1 Define electrical power and energy. 5.2 State the unit of electrical power and energy. 5.3 Show the relation between electrical power and energy. 5.4 List the name of instruments for measuring electrical power and energy. 5.5 Draw the connection diagram of wattmeter and energy meter in an electric circuit. 5.6 Solve problems relating to electrical power and energy.	**3**	**8**
7	**ELECTRICAL WIRES, CABLES, JOINT AND SPLICES** 7.1 Define electrical wires and cables. 7.2 Distinguish between wire and cable. 7.3 Describe the construction and uses of PVC, VIR, TRS or CTS and flexible wires 7.4 Describe the procedure of measuring the size of wires and cables by wire gauge. 7.5 Describe the current carrying capacity of a wire. 7.6 Define the meaning of joints and splices. 7.7 State the five steps of making a joint. 7.8 Explain the procedure to make a pig tail joint, western union joint, Britannia joint, duplex joint, tap joint and simple splice. 7.9 List uses of joints.	**3**	**6**
8	**METHODS OF HOUSE WIRING** 8.1 State the meaning of wiring. 8.2 List the types of wiring.	**4**	**8**

	8.3 State the procedure for channel wiring, surface conduit wring and concealed wiring. 8.4 State the types of wiring used in Residential building and Cinema Hall/Auditorium 8.5 State the types of wiring used in State the types of wiring used in Temporary Sed and Workshop 8.6 List the name of fittings used in different types of electrical wiring. 8.7 Explain the different tests of electrical wiring such as Polarity test, Continuity test, short circuit test, Insulation resistance test and Earth test		
9	**ELECTRICAL CONTROLLING DEVICES.** 9.1 Define controlling device. 9.2 Mention different types of controlling device. 9.3 Describe the constructional features and uses of tumbler switch, iron clad switch, push button switch and gang switch. 9.4 Sketch the wiring diagram of one lamp controlled by one SPST switch and describe its uses. 9.5 Sketch the wiring diagram of one lamp controlled by two SPDT switches and describe its uses. 9.6 Draw the wiring diagram of a calling bell. 9.7 Draw the wiring diagram of a calling bell with more than one lamp controlled from more than one point. 9.8 Draw the wiring diagram of a fluorescent tube light circuit. 9.9 Illustrate the working principle of fluorescent tube light.	**2**	**4**
10	**ELECTRICAL PROTECTIVE DEVICES.** 10.1Define protective device. 10.2 List the different types of protective device. 10.3 List the different types of fuses used in house wiring. 10.4 Describe the construction and uses of renewable fuse. 10.5 Mention the different types of circuit breaker used in house wiring. 10.6 Describe safety procedure against electrical hazards. 10.7 List the performance of safety practices for electrical equipment, machines and accessories. 10.8 Explain the meaning and uses of SPST, SPDT, DPST, DPDT, TPST, Sliding switch, MCB and MCCB. 10.9 Describe the construction of MCB and its advantages.	**3**	**6**
11	**ELECTRICAL EARTHING** 11.1 Define earthing and mention the elements of earthing. 11.2 Explain the necessity of earthing. 11.3 List the different types of earthing.	**4**	**5**

	11.4 List the value of earthing resistance in different conditions. 11.5 Discuss the factors to be considered in performing earthing. 11.6 Explain the working principles of pipe earthing with diagram. 11.7 Narrate the working principles of plate earthing with diagram. 11.8 Explain the working principles of sheet earthing with diagram. 11.9 Describe the working principles of rod earthing with diagram.		
12	**MODERN ELECTRIC LAMPS.** 12.1 Explain the working principle of a fluorescent lamp describing the function of the choke coil and starter. 12.2 Describe constructional details of Sodium Vapor & Mercury Vapor lamps. 12.3 Explain working principle of a Compact Fluorescent lamp with circuit diagram. 12.4 Describe constructional details of a Compact Fluorescent lamp. 12.5 Explain working principle of a Light Emitting Diode (LED) lamp and LED tube light with circuit diagram. 12.6 Describe constructional details of LED lamp and LED tube light. 12.7 Explain working principle of Liquid Crystal Diode (LCD) lamp with circuit diagram. 12.8 Describe constructional details of LCD lamp. 12.9 Describe constructional details of a Cold Cathode Filament (CCF) lamp.	**4**	**6**
13	**Electromagnetism.** 13.1 Describe magnetic field, magnetic lines of force and its properties. 13.2 Describe field intensity and magnetic flux density. 13.3 Distinguish between absolute permeability and relative permeability. 13.4 Describe the concept of magnetic effect of electrical current. 13.5 States Maxwell's cork screw rule and Fleming's left-hand rule. 13.6 Explain the force experienced in a current carrying conductor in a magnetic field. 13.7 Explain the work done by a moving conductor in a magnetic field 13.8. Explain the force between two parallel current carrying conductors.	**4**	**5**

14	**Electromagnetic induction.** 14.1 Define Faraday's laws of electromagnetic induction. 14.2 Describe the magnitude of dynamically induced emf and statically induced emf. 14.3 Solve problems relating to emf generation. 14.4 Define Lenz's law and Fleming's right-hand rule for determining the direction of induced emf and current. 14.5 Define self-induced emf and self-inductance. 14.6 Explain inductance of an iron cored inductor. 14.7 Define mutual inductance and co-efficient of coupling	**4**	**6**
	Total	**48**	**90**

Detailed Syllabus (Practical)

Sl.	Experiment name with procedure	Class (3 Period)	Marks (Continuous)
1	**OBSERVE ELECTRICAL HAND TOOLS AND MEASURING INSTRUMENTS** 1.1 Identify hand tools used in electrical wiring. 1.2 Justify the function of the hand tools used in electrical wiring. 1.3 Draw neat sketches of hand tools used in electrical wiring. 1.4 Identify Voltmeters, Ammeters, Ohmmeter, Wattmeter, Energy meter, AVO meter and Frequency meter, Power factor meter, Lux meter. 1.5 Select & read the scale of given meters. 1.6 Connect correctly voltmeter, ammeter, wattmeter and energy meter to a given circuit. 1.7 Maintain the record of performed task.	**1**	**2**
2	**VERIFY OHM'S LAW.** 2.1 Sketch the circuit diagram for the verification of Ohm's Law. 2.2 List tools, equipment and materials required for the experiment. 2.3 Prepare the circuit according to the circuit diagram using proper equipment. 2.4 Check all connections before the circuit is energized. 2.5 Verify the law by collecting relevant data and calculations. 2.6 Maintain the record of performed task.	**1**	**2**

3	**VERIFY THE CHARACTERISTICS OF SERIES AND PARALLEL CIRCUITS.** 3.1 Draw the working circuit diagram. 3.2 List tools, equipment and materials required for the experiment. 3.3 Prepare the circuit according to the circuit diagram using proper equipment. 3.4 Check all connections before the circuit is energized. 3.5 Record data and verify that in a series circuit total voltage and resistance is equal to the summation of individual voltage and resistance respectively but total current is equal to the individual current. 3.6 Record data and verify that for a parallel circuit supply voltage is equal to the branch voltage, supply current is equal to summation of branch currents and total conductance is equal to the summation of branch conductance. 3.7 Maintain the record of performed task.	**2**	**2**
4	**MEASURE THE POWER OF AN ELECTRIC LOAD.** 4.1 Sketch the necessary circuit diagram of an electrical circuit with electrical load, ammeter, voltmeter and wattmeter. 4.2 Prepare the circuit according to the circuit diagram using ammeter, voltmeter and wattmeter. 4.3 Record the power, measured by the wattmeter and verify the reading with that of calculated from ammeter and voltmeter. 4.4 Compare the measured data with that of calculated and rated power. 4.4 Maintain the record of performed task.	**1**	**2**
5	**MEASURE THE ENERGY CONSUMED IN AN ELECTRICAL LOAD.** 5.1 Sketch the necessary diagram of an electric circuit with wattmeter, energy meter and electrical load. 5.2 Prepare the circuit according to the circuit diagram user wattmeter and energy meter. 5.3 Record the energy measured by the energy meter and verify with that of calculated from wattmeter for a fixed time. 5.4 Maintain the record of performed task.	**1**	**2**

6	**MAKE A PIGTAIL JOINT, T-JOINT, DUPLEX JOINT, TAP JOINT AND SIMPLE SPLICE.** 6.1 Sketch **a pigtail joint, t-joint, duplex joint, tap joint and simple splice.** 6.2 Collect required tools, equipment and materials. 6.3 Perform skinning and scraping of two pieces of PVC cables and two pieces of simplex PVC cables. 6.4 Make the joints according to sketches. 6.5 Maintain the record of performed task.	**1**	**2**
7	**PERFORM WIRING CIRCUIT OF ONE LAMP CONTROLLED FROM ONE POINT** 7.1 Sketch a working diagram of one lamp controlled by one switch. 7.2 Collect required tools, equipment and materials. 7'.3 Complete the wiring circuit using required materials and equipment on wiring board. 7.4 Test the connection of circuit by providing proper supply. 7.5 Maintain the record of performed task.	**1**	**2**
8	**PERFORM WIRING CIRCUIT ONE LAMP CONTROLLED FROM TWO POINTS.** **8.1** Sketch a working circuit of one lamp controlled by two SPDT tumbler switches. 8.2 Collect required tools, equipment and materials. 8.3 Make the wiring circuit using required materials and equipment on a wiring board. 8.4 Test the connection of circuit by providing proper supply. 8.5 Maintain the record of performed task.	**1**	**2**
9	**PERFORM THE WIRING CIRCUIT OF ONE BELL WITH TWO INDICATING LAMPS CONTROLLED FROM TWO POINTS** 9.1 Sketch a working diagram of one bell with two indicating lamps controlled by two push button switches. 9.2 Collect required tools, equipment and materials. 9.3 Make the wiring circuit using required materials and equipment on wiring board. 9.4 Test the connection of circuit by providing proper supply. 9.5 Maintain the record of performed task.	**2**	**2**
10	**PERFORM THE WIRING CIRCUIT OF A FLUORESCENT TUBE LIGHT.** 1O.1Sketch a working diagram of a fluorescent tube light	**2**	**2**

	circuit. 10.2 Collect required tools, equipment and materials. 10.3 Make the connection of a fluorescent tube light circuit using required materials and equipment. 10.4 Test the connection of the circuit by providing supply. 10.5 Maintain the record of performed task.		
11	**PERFORM THE CHANNEL WIRING CIRCUIT OF ONE LAMP, ONE TUBE AND ONE FAN WITH REGULATOR INCLUDING ENERGY METER LIGHT.** 11.1Sketch a circuit diagram of one lamp, one tube light and one fan with regulator including energy meter light. 11.2 Sketch a working diagram on the working board 11.3 Collect necessary tool, equipment and materials. 11.4 Make the connection according to the circuit diagram. 11.5 Set Channel, fittings and Fixture on the working board 11.6 Test the connection of the circuit by providing supply. 11.7 Maintain the record of performed task.	**3**	**4**
	Total	**16**	**25**

Necessary Resources for implement this subject (Tools, equipment's and Machinery):

Sl	Item Name	Quantity
1.	Screw drivers, Neon tester, Pliers, Chisels, Hammer, Mallet, Hack saw, Hand saw, Soldering Iron, Electrician Knife, Wire strippers, Poker, Plumb bob,	Each item 25 no's
2.	Ammeter, Voltmeter, Ohm meter, AVO meter, Wattmeter, Energy meter, Frequency meter, Power factor meter, Lux meter, Megger	Each item 15 no's
3.	Resistor, Inductor, Capacitor	Each item 50 no's
4.	Different types of Wires and Cables (1.0 to 3.5rm	5 coils of different sizes
5.	Switches (SPST, SPDT, SPTT, DPST, DPDT, DPTS, TPST, TPDT, TPTT, Tumbler switch, Push buttom switch, Piano switch, Gang switch, two pin socket, Tree pin socket, Combined switch and socket, two pin plug, Tree pin Plug, Adaptor,	Each item 10 no's
6.	Incandescent Lamp, Fluorescent lamp, Mercury lamp, Vapor lamp, LED, LCD, LED tube light, Hydrogen lamp, Halogen lamp	Each item 25 no's
7.	Calling bell, Choke coil, Starter	Each item 25 no's
8.	Batten holder, Pendent holder, Bracket holder, Tube light holder set	Each item 25 no's

Recommended Books:

Sl	Book Name	Writer Name	Publisher Name & Edition
1.	A text book of Electrical Technology	B. L. Theraja	S.Chand, 2021
2.	Basic Electricity	Charles W. Ryan	S.Chand2021
3.	Basic Electrical theory and Practice	E. B. Babler	S.Chand, 2020
4.	Solved Examples in Electrical Calculation	D. K. Sharma	S.Chand2021
5.	Introduction to Electrical Engineering	V.K. Mehta	S.Chand2021

Website References:

Sl	Web Link	Remarks
1.	http//www.electricalengineering.org	
2.	http//www.electrical-installation.org	
3.	http//www.eetiimes.eu	
4.	http//www.interestingengineering .com	
5.	http//www.electrical-engineering-portal.com	
6.	http//www.electrical4u.com	