



BANGLADESH TECHNICAL EDUCATION BOARD
Agargoan, Dhaka-1207.

4-YEAR DIPLOMA-IN-ENGINEERING PROGRAM
SYLLABUS (PROBIDHAN-2016)

ENVIRONMENTAL TECHNOLOGY

TECHNOLOGY CODE: 690

2nd SEMESTER

DIPLOMA IN ENGINEERING
PROBIDHAN-2016

ENVIRONMENTAL TECHNOLOGY (690)

2nd SEMESTER

Sl. No	Subject Code	Name of the subject	T	P	C	Marks				Total
						Theory		Practical		
						Cont. assess	Final exam	Cont. assess	Final exam	
1	69021	Water Quality Engineering	2	3	3	40	60	25	25	150
2	66422	Civil Engineering Drawing (CAD)	1	3	2	20	30	25	25	100
3	69022	Environmental Engineering Materials	2	3	3	40	60	25	25	150
4	65711	Bangla	3	3	4	60	90	50	0	200
5	65712	English	2	0	2	40	60		0	100
6	65921	Mathematics -2	3	3	4	60	90	50	0	200
7	65912	Physics-1	3	3	4	60	90	25	25	200
Total			16	18	22	320	480	200	100	1100

69021

WATER QUALITY ENGINEERING

T	P	C
2	3	3

AIMS

- To be able to understand the physical, chemical and biological composition of water.
- To be able to understand the water quality standard and regulations.
- To be able to perform the experiments related to water quality.

SHORT DESCRIPTION

Water characteristics and composition, water sampling techniques, physical water quality parameters, chemical water quality parameters, biological water quality parameters, water quality standard and requirements.

DETAIL DESCRIPTION

Theory:

1. General concept of water quality

- 1.1. Define water quality.
- 1.2. Mention the causes of water quality deterioration.
- 1.3. Define water scarcity with examples around the world.
- 1.4. Study the units of water quality parameters

2. Watersampling and quality assessment.

- 2.1. Describe physico-chemical and biological surveillance.
- 2.2. Mention the importance of water sampling.
- 2.3. Identify the location of sampling points
- 2.4. Determine sampling frequency
- 2.5. Describe sampling methods for microbiological analysis
- 2.6. State the storage techniques of sample for microbiological analysis
- 2.7. Describe sampling methods for physico-chemical analysis

3. Physical water quality parameter.

- 3.1. Make a list of physical water quality surveillance.
- 3.2. Define suspended solids.
- 3.3. Explain the sources and impact of suspended solids.
- 3.4. Define total suspended solid (TSS).
- 3.5. Describe the method of total suspended solid (TSS).
- 3.6. Identify the sources and impacts of turbidity.
- 3.7. Describe the method of turbidity measurement.
- 3.8. Describe the measurement method of color, taste, odor of water.

4. Chemical water quality parameters.

- 4.1. Define pH.
- 4.2. Measure the pH of water.
- 4.3. Define electrical conductivity (EC).
- 4.4. Describe the measuring technique of electrical conductivity (EC) of water.
- 4.5. Define total dissolved solids (TDS).
- 4.6. Describe the measuring procedure of total dissolved solids (TDS) in water.
- 4.7. Define hardness.
- 4.8. Mention the causes of hardness.
- 4.9. Describe the measurement method of hardness.

5. Ions presence in water.

- 5.1. Define ion.
- 5.2. Explain ion balance in water.
- 5.3. Define alkalinity, P-alkalinity, M-alkalinity, OH-alkalinity and total alkalinity of water.
- 5.4. Describe the measurement method of alkalinity and salinity.
- 5.5. Mention the sources and role of chloride and fluoride in water.
- 5.6. Describe the measuring method of chloride and fluoride.
- 5.7. Describe the measuring method of free carbon di-oxide, carbonate, bi-carbonate, nitrate, phosphate, sulfate, ammonia present in water.

- 5.8. Describe the measuring method of silicate present in water.
- 6. Metals presence in water.**
 - 6.1. Identify the metals presence in water.
 - 6.2. Explain the trace metal presence in water.
 - 6.3. Describe the measurement method of calcium, magnesium, sodium, potassium, iron, manganese and zinc.
 - 6.4. Describe the measurement method of arsenic, lead, mercury, cadmium, cyanide in water.
- 7. Biological water quality parameters.**
 - 7.1. Define biological monitoring.
 - 7.2. List common water borne pathogens with their impacts.
 - 7.3. Define indicator organism.
 - 7.4. List common types of indicator organisms with their trait.
 - 7.5. Describe the method of total coliform and fecal coliform.
- 8. Organics in water**
 - 8.1. Mention the biodegradable organics presence in water.
 - 8.2. Define dissolved oxygen (DO).
 - 8.3. Describe the method of measuring dissolved oxygen (DO) in water.
 - 8.4. Define biochemical oxygen demand (BOD).
 - 8.5. Describe the method of measuring biochemical oxygen demand (BOD).
 - 8.6. Define chemical oxygen demand (COD).
 - 8.7. Describe the method of measuring chemical oxygen demand (COD).
 - 8.8. Define total organic carbon (TOC).
 - 8.9. Describe the method of measuring total organic carbon (TOC).
- 9. Water quality requirement.**
 - 9.1. Define water quality standard.
 - 9.2. List the average parameters of groundwater, lake or river water, sea water and rain water.
 - 9.3. Describe the composition of water standard as per Bangladesh Standard Testing Institute (BSTI).
 - 9.4. State the composition of water standard as per World Health Organization (WHO).
 - 9.5. Describe wastewater/effluent water standard by Department of Environment (DoE).

Practical:

1. Determine temperature, color, odor, taste, turbidity of water.
2. Measure pH of water sample.
3. Measure As in water sample.
4. Measure the hardness of water sample.
5. Measure total suspended solids (TSS) present in water sample
6. Measure total dissolved solids (TDS) present in water sample.
7. Determine toxic metal (Pb, Cd, & Hg etc.) presents in water.
8. Determine the silica (SiO₂)
9. Measure dissolved oxygen (DO) present in water sample.
10. Measure biochemical oxygen demand (BOD) in water
11. Measure chemical oxygen demand (COD) in water.
12. Determine total bacteria, total coliform and fecal coliform in water.

REFERENCE BOOKS

1. Peavy, Rewe and Tehobanoglous (1985), Environmental Engineering, Me Graw Hill Book Company, New York.
2. American Water Works Association, Water Quality and Treatment –A Hand book community water Suppliers, Edition.
3. Alley, E. Roberts, Water Quality Control Handbook
4. Robert, P.E. Reid, N. and Dekker, Marcel, Water Quality Systems, 2nd Edition, ISBN-0824740106
5. Zuane, John De, (1997), Handbook of Drinking Water Quality, Jhon Wiley and sons, ISBN-047128789

69022 ENVIRONMENTAL ENGINEERING MATERIALS

T	P	C
2	3	3

AIMS

- To be able to identify and classify the materials used for environmental engineering fields.
- To be able to understand the characteristics of various engineering materials.
- To be able to understand the uses of different engineering materials.

SHORT DESCRIPTION

Aspects of engineering materials; Engineering uses of ferrous metals and alloys; Insulating materials; Soundabsorbing materials; Fire and water proofing materials; Fuels and lubricants; Plastic materials, Water and air purification materials.

DETAIL DESCRIPTION

Theory:

1. Various aspects of engineering materials.

- 1.1. Define engineering materials.
- 1.2. Mention the classification of engineering materials in environmental technology.
- 1.3. Mention the general properties of engineering materials.
- 1.4. Identify the importance of engineering materials in Environmental Technology.

2. Basic concept of rocks.

- 2.1. Define rock.
- 2.2. Identify the classification and composition of rock.
- 2.3. Explain the rock cycle.
- 2.4. Describe the formation of rocks.

3. Basic concept of minerals.

- 3.1. Define mineral.
- 3.2. State the properties of minerals.
- 3.3. Identify the classification and composition of minerals.
- 3.4. Mention the growth of minerals.
- 3.5. Describe the identification techniques of minerals.

4. Application of bricks, sands and cement in construction works.

- 4.1. Define brick.
- 4.2. Mention different constituents for manufacturing of good bricks.
- 4.3. Classify sand according to their sources.
- 4.4. Mention the specifications of good sand.
- 4.5. State the use of various grades of sand.
- 4.6. Define cement.
- 4.7. Describe the functions of various ingredients of cement.
- 4.8. Mention the uses of cement as engineering material.

5. Engineering uses of alloys.

- 5.1. Define alloy.
- 5.2. Classify metal alloys with example.
- 5.3. Mention the classification of steel on the basis of carbon content.
- 5.4. Describe the fabrication of metals.
- 5.5. Mention the uses of various alloy steels.
- 5.6. Classify synthetic materials.
- 5.7. Mention the uses of various synthetic materials.
- 5.8. Describe the factors affecting materials properties

6. Uses of polymers and plastics.

- 6.1. Define polymer.
- 6.2. Describe the structure of polymers.
- 6.3. Mention the general properties of polymeric materials.
- 6.4. Classify polymers.
- 6.5. Describe advantages and disadvantages of plastics.
- 6.6. Identify the uses of fiber.
- 6.7. Define plastic.
- 6.8. List the names of raw materials for plastic.
- 6.9. Explain the properties of plastic.
- 6.10 Identify the types and uses of plastic as engineering materials.

7. Application of various heat and sound insulating materials.

- 7.1. Mention the functions of insulating materials.
- 7.2. List heat insulating materials and their application.
- 7.3. Mention the names of synthetic insulating materials.
- 7.4. Describe the uses of asbestos as insulating material.
- 7.5. Mention the names of sound absorbing materials and their uses.
- 7.6. Explain light weight concrete used in acoustic works.

8. Fundamental aspects of fire and water proofing materials.

- 8.1. Mention the term of fire proofing materials and water proofing materials.
- 8.2. List fire resistance materials and their uses.
- 8.3. List water proofing materials and their uses.
- 8.4. Explain the uses of asbestos as fire and waterproof materials.
- 8.5. List the characteristics of refractory materials.

9. Basic concepts of fuels and lubricants.

- 9.1. Define the term fuel and lubricants.
- 9.2. Mention the main purposes of fuels with their classifications.
- 9.3. List the fuel contaminants and their sources.
- 9.4. Describe the pollution process of fuel burning.
- 9.5. List different types of lubricants.
- 9.6. Explain the characteristics of lubricating oils.

10. Water and air purification materials.

- 10.1 Define Absorbent and Adsorbent.
- 10.2 Mention the types of absorbent and adsorbent.
- 10.3 Explain the characteristics of good absorbent and adsorbent.
- 10.4 Define following terms: Lime, Activated alumina, Activated carbon, Alum, Bleaching powder, CIM, Resin, Silica gel, Soda-ash, Zeolite.
- 10.5 Mention the Constituents of charcoal and Classification of charcoal.
- 10.6 Mention the types of Resin.
- 10.7 Mention the classification of Zeolite.
- 10.8 Describe arsenic removal materials.
- 10.9 Describe air pollutant removal materials.

Practical:

1. Show skill in identifying various types of rock

- 1.1. Selected different type of rock in the laboratory.
- 1.2. Sketch different type of rock on the basis of formation.

2. Show skill in field test of bricks

- 2.1. Perform field test of bricks

2.2. Select 1st class, 2nd class, 3rd class bricks and jhama bricks

3.Show skill in conducting laboratory test of bricks

3.1. Perform:

- (a) Compression test
- (b) Absorption test

3.2. Determine average weight of a brick.

4.Show skill in conducting laboratory test of cement

4.1. Conduct laboratory tests of cement

- (a) Make cement paste of Normal Consistency (CPNC)
- (b) Determine initial setting time
- (c) Perform final setting time
- (d) Perform compressive strength test
- (e) Perform tensile strength test
- (f) Perform fineness test

4.2. Conduct field tests of cement

5.Show skill in conducting tests of coarse aggregate

- (a) Specific gravity of sand
- (b) Grading of aggregates

6.Show skill in conducting test of sand

- (a) Bulking of sand
- (b) F M of sand
- (c) Specific gravity of sand

7. Show skill in identifying various ferrous and nonferrous metals

7.1. Identify mild steel, cast iron, copper, and aluminum, tin by physical observation.

8.Show skill in identifying various type of Lime, Activated alumina, Alum, Resin, Bleaching powder, CIM, Zeolite.

9.Show skill in identifying various types of water and air purification materials.

REFERENCE BOOKS

1. A text book on Engineering Materials –G. J. Kulkarni
2. Engineering Materials –M. A. Aziz
3. Water Supply & Sanitation- M. Feroze Ahemed, Md. Mujibur Rahman

উদ্দেশ্য :

১. মাতৃভাষা হিসেবে বাংলা ভাষার প্রকৃতি ও বৈশিষ্ট্য সম্পর্কে ধারণা লাভ। ভাষার ব্যবহারে প্রায়োগিক যোগ্যতা অর্জন।
২. বাংলা সাহিত্য পঠন-পাঠনের মাধ্যমে জাতীয় চেতনা, দেশপ্রেম, মুক্তিযুদ্ধের চেতনা, শুদ্ধাচার, নীতি ও মূল্যবোধের উন্মোচন ঘটানো।

সংক্ষিপ্ত বিবরণী :

মাতৃভাষা ও সৃজনশীলতা : বাংলা ভাষা রীতির বিচিত্রতা, বানান রীতি, পত্র রচনা এবং কবিতা, প্রবন্ধ, নাটক, উপন্যাস ও ছোট গল্প।
বিশদ বিবরণী:

১. বাংলা ভাষার প্রয়োগ:

ক) বাংলা ভাষা :

ভাষার সংজ্ঞা, বাংলা ভাষা রীতি - সাধু, চলিত, আঞ্চলিক বা উপভাষা (সংজ্ঞা, বৈশিষ্ট্য, পার্থক্য ও উদাহরণ)

খ) বাংলা বানান রীতি ও শব্দ প্রয়োগ:

১. বাংলা একডেমির প্রমিত বানান রীতি, ণ-ত্ব ও ষ-ত্ব বিধি

২. শব্দ ও শব্দের শ্রেণি বিভাগ (সংজ্ঞা, শব্দের গঠন, উৎস বা উৎপত্তি ও অর্থগত)

৩. বাক্য প্রকরণ ও গঠন রীতি (সংজ্ঞা, বাক্য গঠন এবং প্রকার)

গ) পত্র রচনা :

আবেদন পত্র (চাকুরি, ছুটি), চাকুরিতে যোগদান পত্র, মানপত্র, স্মারকলিপি, সংবাদপত্রে প্রকাশের জন্য পত্র

২. বাংলা সাহিত্য:**ক. কবিতা :**

১. বঙ্গভাষা -মাইকেল মধুসূদন দত্ত

২. সোনার তরী - রবীন্দ্র নাথ ঠাকুর

৩. উমর ফারুক - কাজী নজরুল ইসলাম

৪. বাংলার মুখ আমি- জীবনানন্দ দাশ

৫. আসাদের শাট - শামসুর রাহমান

৬. স্বাধীনতা শব্দটি কি করে আমাদের হলো? - নির্মলেন্দু গুণ

খ. প্রবন্ধ :

১. অর্ধাঙ্গী -রোকেয়া সাখাওয়াত হোসেন

২. বই কেনা - সৈয়দ মুজতবা আলী

গ. একাঙ্কিকা (নাটিকা): মানুষ -মুনির চৌধুরী

ঘ. উপন্যাস: লালসালু - সৈয়দ ওয়ালী উল্লাহ

ঙ. ছোট গল্প:

১. হৈমন্তী - রবীন্দ্র নাথ ঠাকুর

২. একুশের গল্প - জহির রায়হান

৩. পাতালেহাসপাতালে - হাসান আজিজুল হক

ব্যবহারিক**১. নির্ধারিত বক্তৃতা :**

বাংলাদেশ ও বাঙালি সংস্কৃতি, বিভিন্ন জাতীয় দিবস (একুশে ফেব্রুয়ারি ও আন্তর্জাতিক মাতৃভাষা দিবস, স্বাধীনতা দিবস, বিজয় দিবস, জাতীয় শোক দিবস, মুজিব নগর দিবস, মহান মে দিবস)
প্রাতিষ্ঠানিক বক্তৃতা- নবাগত শিক্ষক/ছাত্রছাত্রীদের বরণ, গুরুত্বপূর্ণ ব্যক্তিবর্গের আগমন উপলক্ষে বক্তৃতা।

২. উপস্থিত বক্তৃতা :

বিষয়বস্তু উন্মুক্ত

৩. আবৃত্তি :

১. মানুষ - কাজী নজরুল ইসলাম
২. আকাশ নীলা - জীবনানন্দ দাশ
৩. পল্লী জননী - জসীম উদ্দীন
৪. ছাড়পত্র - সুকান্ত ভট্টাচার্য
৫. তোমাকে পাওয়ার জন্য হে স্বাধীনতা - শামসুর রাহমান
৬. নিষিদ্ধ সম্পাদকীয় - হেলাল হাফিজ

৪. বিভর্ক (নমুনা)

সংস্কৃতিই আধুনিক মানুষের ধর্ম

তথ্য প্রযুক্তির অবাধ ব্যবহারই যুব সমাজের অবক্ষয়ের মূল কারণ

গতানুগতিক শিক্ষা নয় কর্মমুখি শিক্ষাই অর্থনৈতিক মুক্তির চাবিকাঠি

চালকের অসাবধানতাই সড়ক দুর্ঘটনার প্রধান কারণ

মুক্তিযুদ্ধের চেতনাই অসাম্প্রদায়িক বাংলাদেশ প্রতিষ্ঠার মূলমন্ত্র

প্রযুক্তির বিকাশই প্রকৃতি বিনাশের একমাত্র কারণ

৫. প্রতিবেদন প্রণয়ন ও উপস্থাপন:

স্থানীয় বিভিন্ন সমস্যা ও অনুসন্ধানী যে কোন বিষয়।

Objectives:

After The Completion of the Course, Learners Will Be Able To Develop-

- Reading, Listening With Understanding
- The Fluency Of Speech
- Grammatical Accuracy With Emphasis On Spelling & Punctuation
- Creative Writing

Seen Comprehension: (Marks-20)

Unit	Lesson	Title
People Or Institutions Making History (Unit One)	1	Nelson Mandela ,From Apartheid Fighter To President
	2	The Unforgettable History
Food Adulteration(Unit Three)	1	Food Adulteration Reaches Height
	2	Eating Habit And Hazards
Human Relationship(Unit Four)	2	Love And Friendship
Environment And Nature (Unit Eight)	1	Water ,Water Everywhere
	5	Kuakata: Daughter Of The Sea
Greatest Scientific Achievement (Unit Thirteen)	1	Some Of The Greatest Scientific Achievements Of The Last 50 Years
	2	Science And Technology Against An Age- Old Disease
Art And Music (Unit Fourteen)	1	What Is Beauty?
	3	Crafts In Our Time
Tours And Travels (Unit Fifteen)	1	Travelling To A Village In Bangladesh
	4	The Wonders of Vilayet

N.B: The Unit Mentioned Refers To The Text Book (1st Paper) English For Today For Class 11- 12
By National Curriculum & Text Book Board, Dhaka.

Grammar (Marks-20)**1. (A) Uses of Articles.**

(B) Uses of Tense *(Right Forms Of Verbs with Indicators)

(C) Classify Verbs: (Regular and Irregular Verbs, Auxiliary, Principal, Finite, Non-Finite Verbs,)

2. Sentence:

(A) Changing Sentences: (Assertive, Interrogative, Optative, Imperative, Exclamatory Simple, Complex and Compound), Comparison of Adjectives/Adverbs

(B) Question Making: WH, Yes/No, Tag Question

3. Enrich Vocabulary: Synonyms, Antonyms; Suffix And Prefix.

4. Voice, Narration

5. Sentence Analysis:

Study of Part of Speech, (Type Of Verbs-Regular and Irregular Verbs, Auxiliary and Principal Verb)

Study of Phrases and Clauses (Noun/ Adjective/ Verb/ Participle /Adverbial/ Prepositional Phrases and Principal /Sub Ordinate /Co Ordinate Clauses)

Free Writing (Marks -20)

1. Write Dialogues: (With Teacher, Principal, Shopkeeper, Hotel Manager, Station Master, Newcomer, Buyers, Doctor, Friend, Colleagues Etc).
2. Report Writing On Different Events/ Occasions/ Accidents.
3. Writing Situational Personal and Official Letters.
4. Writing Job Application with CV /Appointment Letter / Joining Letter
5. Write A Guided Paragraph With Questions.

OBJECTIVES

- To enable in solving the simultaneous equations with the help of determinant and matrix.
- To make understand the exponential series.
- To provide ability to apply the knowledge of differential calculus in solving problem like slope, gradient of a curve, velocity, acceleration, rate of flow of liquid etc.
- To enable to apply the process of integration in solving practical problems like calculation of area of a regular figure in two dimensions and volume of regular solids of different shapes.

SHORT DESCRIPTION

Algebra : Determinants, Matrix, Exponential Series.

Trigonometry : Inverse circular functions, Properties of triangle and solution of triangles.

Differential Calculus : Function and limit of a function, differentiation with the help of limit, differentiation of functions, geometrical interpretation of $\frac{dy}{dx}$, successive differentiation and Leibnitz theorem, partial differentiation.

Integral Calculus : Fundamental integrals, integration by substitutions, integration by parts, integration by partial fraction, definite integrals.

DETAIL DESCRIPTION**ALGEBRA :****1 Apply determinants to solve simultaneous equations.**

- 1.1 Expand a third order determinant.
- 1.2 Define minor and co-factors.
- 1.3 State the properties of determinants.
- 1.4 Solve the problems of determinants.
- 1.5 Apply Cramer's rule to solve the linear equation.

2 Apply the concept of matrix.

- 2.1 Define matrix, null matrix, unit matrix, square matrix. column matrix, row matrix, inverse matrix, transpose matrix, adjoint matrix, rank of a matrix, singular matrix.
- 2.2 Explain equality, addition and multiplication of matrix.
- 2.3 Find the rank of a matrix.
- 2.4 solve the problems of the following types:
 - i) Solve the given set of linear equations with the help of matrix.
 - ii) Find the transpose and adjoint matrix of a given matrix.

3 Understand exponential series.

- 3.1 Define e.
- 3.2 Prove that e is finite and lies between 2 and 3.
- 3.3 Prove that $e^x = 1 + \frac{x}{1} + \frac{x^2}{2!} + \frac{x^3}{3!} + \frac{x^4}{4!} + \dots$ to ∞
- 3.4 Solve problems of the followings types :
 - i) $1 + \frac{1}{2!} + \frac{1}{4!} + \frac{1}{6!} + \dots$ to ∞
 - ii) $\frac{1}{2!} + \frac{1+2}{3!} + \frac{1+2+3}{4!} + \frac{1+2+3+4}{5!} + \dots$ to ∞

TRIGONOMETRY**4 Apply the concept of inverse circular function.**

- 4.1 Explain the term inverse circular function and principal value of a trigonometrical ratio.

- 4.2 Deduce mathematically the fundamental relations of different circular functions.
 4.3 Convert a given inverse circular function in terms of other functions.
 4.4 Prove mathematically

$$\begin{aligned} \text{i)} \quad & \tan^{-1} x + \tan^{-1} y = \tan^{-1} \frac{x+y}{1-xy} . \\ \text{ii)} \quad & \tan^{-1} x + \tan^{-1} y + \tan^{-1} z = \tan^{-1} \frac{x+y+z-xyz}{1-xy-yz-zx} \\ \text{iii)} \quad & \sin^{-1} x + \sin^{-1} y = \sin^{-1} \left(x\sqrt{1-y^2} + y\sqrt{1-x^2} \right) \\ \text{iv)} \quad & 2 \tan^{-1} x = \sin^{-1} \frac{2x}{1+x^2} = \cos^{-1} \frac{1-x^2}{1+x^2} = \tan^{-1} \frac{2x}{1-x^2} \end{aligned}$$

- 4.5 Solve problems of the following types.

- a) $2 \tan^{-1} \frac{1}{3} + \tan^{-1} \frac{1}{4} = \frac{\pi}{4}$
 b) $\cos \tan^{-1} \cot \sin^{-1} x = x$.
 c) Prove that the area of the segment cut from a circle of radius r by a chord at a distance d from the centre is given by
- $$K = r^2 \cos^{-1} \frac{d}{r} - d\sqrt{r^2 - d^2}$$

5 Apply the principle of properties of triangles.

- 5.1 Prove the followings identities :

$$\begin{aligned} \text{i)} \quad & \frac{a}{\sin A} = \frac{b}{\sin B} = \frac{c}{\sin C} = 2R . \\ \text{ii)} \quad & a^2 = b^2 + c^2 - 2bc \cos A \\ \text{iii)} \quad & a = b \cos C + c \cos B . \\ \text{v)} \quad & \Delta = \frac{1}{2} bc \sin A . \end{aligned}$$

- 5.2 Establish the followings.

$$\begin{aligned} \text{a)} \quad & \tan \frac{A}{2} = \sqrt{\frac{(s-b)(s-c)}{s(s-a)}} \\ \text{b)} \quad & \tan \frac{B-C}{2} = \frac{b-c}{b+c} \cot \frac{A}{2} \\ \text{c)} \quad & \Delta = \frac{abc}{4R} \end{aligned}$$

- 5.3 Solve the problems of the following types:

- i) Prove $\cos(B-C) + \cos A = \frac{bc}{2R}$
 ii) An object experiences two forces F_1 and F_2 of magnitude 9 and 13 Newtons with an angle 100° between their directions. Find the magnitude of the resultant R .

DIFFERENTIAL CALCULUS

6 Understand the concept of functions.

- 6.1 Define constant, variable, function, domain, range
 6.2 Solve problems related to functions.

7 Understand the concept of limits.

- 7.1 Define limit and continuity of a function.
 7.2 Distinguish between $\lim_{x \rightarrow a} f(x)$ and $f(a)$.

7.3 Establish (i) $\lim_{x \rightarrow 0} \frac{\sin x}{x} = 1$

$$(ii) \lim_{x \rightarrow 0} \frac{\tan x}{x} = 1$$

8 Understand differential co-efficient and differentiation.

8.1 Define differential co-efficient in the form of

$$\frac{dy}{dx} = \lim_{h \rightarrow 0} \frac{f(x+h) - f(x)}{h}$$

8.2 Find the differential co-efficient of algebraic and trigonometrical functions from first principle.

9 Apply the concept of differentiation.

9.1 State the formulae for differentiation:

- (i) sum or difference
- (ii) product
- (iii) quotient
- (iv) function of function
- (v) logarithmic function

9.2 Find the differential co-efficient using the sum or difference formula, product formula and quotient formula.

9.3 Find the differential co-efficient function of function and logarithmic function.

10 Apply the concept of geometrical meaning of $\frac{dy}{dx}$

10.1 Interpret $\frac{dy}{dx}$ geometrically.

10.2 Explain $\frac{dy}{dx}$ under different conditions

10.3 Solve the problems of the type:

A circular plate of metal expands by heat so that its radius increases at the rate of 0.01 cm per second. At what rate is the area increasing when the radius is 700 cm ?

11 Use Leibnitz's theorem to solve the problems of successive differentiation.

11.1 Find 2nd, 3rd and 4th derivatives of a function and hence find n-th derivatives.

11.2 Express Leibnitz's theorem

11.3 Solve the problems of successive differentiation and Leibnitz's theorem.

12 Understand partial differentiation.

12.1 Define partial derivatives.

12.2 State formula for total differential.

12.3 State formulae for partial differentiation of implicit function and homogenous function.

12.4 State Euler's theorem on homogeneous function.

12.5 Solve the problems of partial derivatives.

INTEGRAL CALCULUS

13 Apply fundamental indefinite integrals in solving problems.

13.1 Explain the concept of integration and constant of integration.

13.2 State fundamental and standard integrals.

13.3 Write down formulae for:

- (i) Integration of algebraic sum.
- (ii) Integration of the product of a constant and a function.

13.4 Integrate by method of substitution, integrate by parts and by partial fractions.

13.5 Solve problems of indefinite integration.

14 Apply the concept of definite integrals.

14.1 Explain definite integration.

14.2 Interpret geometrically the meaning of $\int_a^b f(x) dx$

14.3 Solve problems of the following types:

$$(i) \int_0^{\pi/2} \cos^2 x \, dx. \quad (ii) \int_0^1 \frac{(\sin^{-1} x)^2}{\sqrt{1-x^2}} dx$$

		Reference	
SL No	Athour	Title	Publication
01	S. P Deshpande	Mathematics for Polytechnic Students	Pune Vidyarthi Graha Prakashan
02	H. K. Das	Mathematics for Polytechnic Students(Volume I)	S.Chand Prakashan
03	Shri Shantinakaran	Engg.Maths Vol I & II	S.Chand & Comp
04	Dr. B M Ekramul Haque	Higher Mathematics	Akshar Patra Prakashani
05	Md. Abu Yousuf	Differential & Integral Calculus	Mamun Brothers

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PHYSICS-1

T P C
3 3 4

OBJECTIVES

- To develop the students a background of basic science i.e. Physics required for understanding technological subjects.
- To develop a working knowledge of common engineering and industrial materials and to enable to determine through experiments the properties of such materials.
- To develop through experiments an understanding of fundamental scientific concept.
- To develop a basic knowledge and concept of physical properties of common engineering and industrial materials.

SHORT DESCRIPTION

Measurement, Units; Vector and Scalar quantities; Motion and Equations of motion; Force and Newton's Laws of motion; Gravity and Gravitation; Simple Harmonic motion; Hydrostatics; Surface tension and viscosity; Pressure, Sound; wave and sound Concepts and nature of sound, Velocity of sound, Ultrasonic.

DETAIL DESCRIPTION

THEORY :

1. PHYSICAL WORLD AND MEASUREMENT

- 1.1. Nature of Physical World.
- 1.2. Scope and Excitement of Physics.
- 1.3. Few Terms about Physics.
- 1.4. Physics and other world of Technological Knowledge.
- 1.5. Principle of Measurement.
- 1.6. Fundamental and Derived Quantities and Units.
- 1.7. Dimensions of Units.
- 1.8. Errors in Measurement.

2. SCALAR AND VECTOR QUANTITIES

- 2.1 Define vector and scalar quantities with examples.
- 2.2 Show the various representations of the vector quantities; and representation of a vector by unit vector.
- 2.3 Find and explain the resultant of two vectors in different directions.
- 2.4 Resolve a vector into horizontal & vertical component.
- 2.5 Explain the dot and cross product of two vectors.
- 2.6 Define laws of triangle of vector.

3. MOTION AND EQUATIONS OF MOTION

- 3.1 Define rest and motion
- 3.2 Classify and explain of motion.
- 3.3 Define and explain displacement, speed, velocity, acceleration and retardation.
- 3.4 Deduce the relationship between displacement, velocity, acceleration and retardation from these definitions.
- 3.5 Motion of a Projectile.
- 3.6 Equation of motion of a freely moving body thrown obliquely vertically upward or motion of a projectile.
- 3.7 Define angular velocity and linear velocity with their units.
- 3.8 Deduce the relation between angular velocity and linear velocity.
- 3.9 Define centripetal and centrifugal force with examples.
- 3.10 Prove that centrifugal force = $\frac{mv^2}{r}$

- 3.11 State and explain the laws of falling bodies and mention the equation of motion of a body when it is projected vertically upwards or downwards.

4. NEWTON'S LAWS OF MOTION FORCE AND FRICTION

- 4.1 Define force.
4.2 State Newton's laws of motion.
4.3 Define different units of force and their correlation and also mention the dimension of force.
4.4 Prove $P=mv$, from Newton's 2nd law of motion.
4.5 Find out the resultant of parallel forces.
4.6 Define inertia and momentum
4.7 State and prove the principles of conservation of momentum.
4.8 Define friction and describe the different kinds of friction.
4.9 Define the co-efficient of static friction.
4.10 Show that the co-efficient of static friction is equal to the tangent of angle of repose
4.11 State the merits and demerits of friction.

5. GRAVITY AND GRAVITATION

- 5.1 Define and explain the Kepler's Law.
5.2 Define gravity and gravitation.
5.3 Define and determine the gravitational constant (G) and also mention its units and dimension.
5.4 Define acceleration due to gravity 'g' and also mention its units and dimension.
5.5 Discuss the variation of 'g' at different places.
5.6 Define mass and weight with their units and dimension.
5.7 Distinguish between mass and weight.
5.8 Define and explain gravitational potential and escape velocity

6. SIMPLE HARMONIC MOTION (SHM)

- 6.1 Define Periodic and simple harmonic motion (SHM).
6.2 State the characteristics of SHM.
6.3 Describe a simple pendulum and a second pendulum.
6.4 Define effective length, amplitude, phase, complete oscillation, period of oscillation, frequency.
6.5 State and explain the laws of simple pendulum.
6.6 Motion of simple pendulum and its time period.

7. WORK, POWER AND ENERGY

- 7.1 Define work, power and energy.
7.2 State the units and dimensions of work, power and energy.
7.3 State and prove the principle of the conservation of energy.
7.4 Define potential energy (PE) and kinetic energy (KE).
7.5 Derive the equation of potential and kinetic energy.
7.6 Recognize that the useful work can be found from:

$$\text{Efficiency} = \frac{\text{output work}}{\text{input work}} \times 100.$$

8. ELASTICITY

- 8.1 Name some of the general and special properties of matter.
- 8.2 Define Elasticity and Elastic limit.
- 8.3 Define perfectly elastic body and perfectly rigid body.
- 8.4 Define stress and strain with their units and dimensions.
- 8.5 State and explain the Hook's law.
- 8.6 Describe various kinds of modulus of elasticity.
- 8.7 Mention the units and dimensions of modulus of elasticity.
- 8.8 Define and explain Poisson's ratio.

9. HYDROSTATICS

- 9.1 Define pressure as force per unit area and state that it is measured in N/m^2 or Pascal.
- 9.2 State characteristics of liquid pressure.
- 9.3 Establish the pressure at a point in a fluid depend upon the density of the fluid, the depth in the fluid and acceleration due to gravity.
- 9.4 Surface tension and surface energy, Angle of contact.
- 9.5 Capillarity and theory of capillarity.
- 9.6 Viscosity and co-efficient of viscosity.
- 9.8 Necessity of viscosity.

10. WAVE AND SOUND

- 10.1 Wave and wave motion.
- 10.2 Transverse wave and longitudinal wave.
- 10.3 Some definitions relating waves.
- 10.4 Progressive wave and stationary waves.
- 10.5 Equation of progressive wave.
- 10.6 Sound and production of sound.
- 10.7 Sound is a longitudinal traveling wave.
- 10.8 Interference of sound: Constructive and Destructive interference.
- 10.9 Define beats and Mechanism of formation of beats.

11. SOUND AND VELOCITY OF SOUND

- 11.1 Identify that sound is produced by vibration and travels through a medium as a longitudinal wave.
- 11.2 Recognize that sound can be produced of different pitches (frequencies) & that the human ear has an audible frequency range covering approximately 20 Hz to 20 KHz.
- 11.3 State the approximate frequency range for
 - a. infrasonic sound, b. Ultrasonic (supersonic) sound.
- 11.4 Explain how sound is absorbed, reflected & refracted by different types of surface.
- 11.5 Describe the practical uses of echo sounding devices.
- 11.6 Define velocity of sound.
- 11.7 State the velocity of sound at NTP in still air.
- 11.8 Compare the effects of pressure, temperature & humidity on the velocity of sound in air.

PRACTICAL

1. Determine accurate diameter/side of an object using vernier calipers.
2. Measure the area of cross section of a wire by micrometer screw gage.
3. Measure the thickness of a glass plate by speedometer.
4. Verify the law of parallelogram of forces by a force board.
5. Draw $L-T^2$ graph and determine the value of “g” by using a simple pendulum.
6. Determine the coefficient of static friction.
7. Determine Young’s modulus of a steel wire by Searle’s apparatus.
8. Determine gravity of a solid heavier than and insoluble in water by hydrostatic balance.
9. Determine specific gravity of a liquid by specific gravity bottle.
10. Determine velocity of sound by resonance air column method.

REFERENCE BOOKS:

- | | |
|--|----------------------------------|
| 1. Higher Secondary Physics - First Part | - by Dr. Shahjahan Tapan |
| 2. A Text Book of Properties of matter | -By N Subrahmanyam and Brij Lal |
| 3. A Text Book of Sound | -By N Subrahmanyam and Brij Lal |
| 4. Higher Secondary Physics- First Part | -by Prof. Golam Hossain Pramanik |
| 5. Higher Secondary Physics- First Part | -by Ishak Nurfugnabi |



BANGLADESH TECHNICAL EDUCATION BOARD

4-YEAR DIPLOMA-IN-ENGINEERING PROGRAM
SYLLABUS (PROBIDHAN-2016) (খসড়া)

Environmental Technology
TECHNOLOGY CODE: 90

SYLLABUS
(PROBIDHAN-2016)

FIRST SEMESTER

DIPLOMA IN ENGINEERING
PROBIDHAN-2016

Environment Technology
1st Semester

Sl. No	Subject Code	Name of the subject	T P C			Marks				
						Theory		Practical		Total
						Cont. assess	Final exam	Cont. assess	Final exam	
1	69011	Basic Environmental Engineering	2	3	3	40	60	25	25	150
2	61011	Engineering Drawing	0	6	2	0	0	50	50	100
3	66712	Electrical Engineering Fundamentals	3	3	4	60	90	25	25	200
4	65812	Physical Education & Life Skill Development	0	3	1	0	0	25	25	50
5	65911	Mathematics-1	3	3	4	60	90	50	0	200
6	65913	Chemistry	3	3	4	60	90	25	25	200
7	65811	Social Science	3	0	3	60	90	0	0	150
	Total		14	21	21	280	420	200	150	1050

BASIC ENVIRONMENTAL ENGINEERING

T	P	C
2	3	3

OBJECTIVES

This course is designed to introduce students to the fundamental concepts and properties of environmental engineering. Upon completing the course, the student will be able to;

- Identify and define the concepts and properties of environmental engineering, including components of environment.
- Realize the role of environmental engineers to protect environment.
- Describe the importance of environment and its conservation.
- Describe contemporary environmental engineering issues and solutions.
- Describe the similarities and differences of the environmental engineering options.
- Apply the professional codes to evaluate situations that may encounter in career.

SHORT DESCRIPTION

Environment, environmental engineering, component of environment, air, water soil, ecology and ecosystem, energy and nutrients, biomes, environment and development, biodiversity, global environmental challenges.

DETAIL DESCRIPTION

THEORY

1. Understand the basic concept of environmental engineering.

- 1.1. Define environment.
- 1.2. Describe the components of environment.
- 1.3. Define of environmental engineering.
- 1.4. Describe the branches of environmental engineering.
- 1.5. Describe the scope of environmental engineering.
- 1.6. Describe the role of environmental engineers in the improvement of environmental quality.
- 1.7. Define the following terms:
Hydrosphere, atmosphere, lithosphere, biosphere, ecosphere, pollution, pollutants, contaminants, particulates, suspended particulates, effluent, emission, threshold limit value (TLV), aeration, aerobic, anaerobic, abiotic, biotic, biomass, flora, fauna, microorganism.
- 1.8. Define natural and man-made environment.
- 1.9. Distinguish between natural and man-made environment.

2. Understand the air as a component of environment.

- 2.1. Define air.
- 2.2. Describe the composition of the clean dry atmospheric air at ground level.
- 2.3. Describe the atmospheric structure.
- 2.4. Define air pollution.
- 2.5. Describe major air pollutants and their impacts.
- 2.6. Describe the sources of air pollutants.
- 2.7. Describe the effects of air pollution on vegetation, animal, human health and materials and resources.
- 2.8. Define sound and noise.
- 2.9. Describe the units of sound.
- 2.10. Describe the classification of sound.
- 2.11. Describe the effects of noise.

3. Understand the water as a component of environment.

- 3.1. Define water.
- 3.2. Describe the sources of water.
- 3.3. Describe the characteristics of water.
- 3.4. Describe the uses of water.

- 3.5. Explain that water is a universal solvent.
- 3.6. Define water pollution.
- 3.7. Describe the sources of water pollution.
- 3.8. Describe the effects of water pollution.

4. Understand the soil as a component of environment.

- 4.1. Define soil.
- 4.2. Describe the formation of soil.
- 4.3. Describe the constituents of soil.
- 4.4. Describe soil profile.
- 4.5. Describe soil texture.
- 4.6. Describe the inner structure of earth.
- 4.7. Define soil pollution.
- 4.8. Describe causes soil degradation.
- 4.9. Describe the sources of soil pollution.
- 4.10. Describe the effects of soil pollution.

5. Understand the basic concept of ecology and eco system.

- 5.1. Define ecology.
- 5.2. Define ecosystem.
- 5.3. Describe ecological factors.
- 5.4. Describe the meaning of following terms:
Population, community, climax community, ecological niche, habitat, plankton, nekton, benthos, ecological indicator, ecotype, ecotone, biological clock, community periodicity, adaptation.
- 5.5. Describe the components of ecosystem.
- 5.6. Describe interdependency between abiotic and biotic component.
- 5.7. Describe the classification of ecosystem.
- 5.8. Describe the ecosystem of pond, ocean, estuary, grassland, cropland, forest, desert, and mangrove.

6. Understand the environmental factors and ecology.

- 6.1. Define environmental factors.
- 6.2. Describe climatic factors.
- 6.3. Describe topographic factors.
- 6.4. Describe edaphic factors.
- 6.5. Describe biotic factors.
- 6.6. Describe interdependency of organism.
- 6.7. Define biome.
- 6.8. Describe the classification of biome.
- 6.9. Describe terrestrial, marine and fresh-water biome.

7. Understand the energy flow in ecosystem.

- 7.1. Describe the basic energy flow model in ecosystem.
- 7.2. Describe food cycle.
- 7.3. Describe food chain.
- 7.4. Describe classification of food chain.
- 7.5. Describe trophic level.
- 7.6. Describe food web.
- 7.7. Describe ecological pyramid.
- 7.8. Describe classification ecological pyramid.

8. Understand the productivity of ecosystem.

- 8.1. Define nutrients.
- 8.2. Define ecological efficiency.
- 8.3. Describe production of ecosystem.
- 8.4. Define biogeochemical cycle.

8.5. Describe hydrological cycle, carbon cycle, nitrogen cycle, oxygen cycle, phosphorus cycle and sulfur cycle.

9. Understand the stability of ecosystem.

- 9.1. Describe the factors of ecosystem stability.
- 9.2. Describe succession or biotic development.
- 9.3. Describe primary succession.
- 9.4. Describe secondary succession.
- 9.5. Describe limiting factors of ecosystem.
- 9.6. Describe bioconcentration or bioaccumulation.
- 9.7. Describe biological magnification or biomagnification.

10. Understand the environment and development.

- 10.1. Define environmental ethics.
- 10.2. Describe laws of nature.
- 10.3. Describe environmental stress.
- 10.4. Define sustainable development.
- 10.5. Describe self-purification and regeneration of environment.
- 10.6. Define urbanization.
- 10.7. Describe the causes of urbanization.
- 10.8. Describe the effects of urbanization on environment.
- 10.9. Define industrialization.
- 10.10. Describe the causes of industrialization.
- 10.11. Describe the effects of industrialization on environment.

11. Understand the concept of biodiversity.

- 11.1. Define biodiversity.
- 11.2. Describe the composition of biodiversity.
- 11.3. Describe the values of biodiversity.
- 11.4. Describe the factors affecting biodiversity.
- 11.5. Describe the threats to biodiversity.
- 11.6. Describe the conservation of biodiversity.

12. Understand the global environmental challenges.

- 12.1. Define greenhouse gas and greenhouse effects.
- 12.2. Make a list of greenhouse gases and their contribution on greenhouse effects.
- 12.3. Describe the causes and effects of greenhouse effects.
- 12.4. Describe acid rain.
- 12.5. Describe importance of ozone layer.
- 12.6. Define ozone depleting substances (ODS).
- 12.7. Describe ozone layer depletion.
- 12.8. Describe hazardous waste.
- 12.9. Describe chemicals pesticides.
- 12.10. Describe the toxic chemicals hazards.
- 12.11. Describe radioactive pollution.
- 12.12. Describe natural disaster.

PRACTICAL

- 1. Study the components and their functions of a plant cell with microscope.
- 2. Determine and count the species of a grass land.
- 3. Determine the biodiversity of mangrove forest.
- 4. Determine the characteristics of hydrophytes, xerophytes, mesophytes and lithophytes.
- 5. Determine the ecological succession of a pond.
- 6. Determine the soil structure of a bog.
- 7. Find out sources of urban water pollution.
- 8. Find out sources of industrial pollution.

9. Find out sources of air pollution in an industrial area.
10. Find out the effects of environmental pollution.
11. Determine noise level of an industrial area.
12. Make a diagram of greenhouse effects.

REFERENCES

1. Principles of Environmental Science & Engineering - P. VeugopalaRao.
2. Environmental Science: towards a sustainable future - Richard T. Wright and Bernard J. Nebel.
3. Basic Environmental Engineering - R.C. Gaur.
4. Ecology and Environment - P.D Sharma.
৫. পরিবেশ দূষণ - গৌতমপাল

OBJECTIVES

- To develop the ability to use various drawing instruments and materials.
- To enable in constructing and using various types of scales in drawing.
- To provide the ability to construct various geometrical figures.
- To enable to adopt various symbols used in drawing.
- To understand the orthographic and isometric projection.

SHORT DESCRIPTION

Drawing instruments and their uses; Lettering, numbering and constructing title strip; Adopting alphabet of lines and dimensioning; Constructing scales; Constructing geometrical figures; Constructing conic sections; Adopting symbols; Views and isometric projections.

DETAIL DESCRIPTION

DRAWING INSTRUMENTS AND MATERIALS

- 1 Practice with drawing instruments and materials for basic drawing technique.**
 - 1.1 Identify the different types of drawing instruments.
 - 1.2 Use different types of drafting equipment.
 - 1.3 Use different types of drafting software.
 - 1.4 Identify the standard sizes of drawing board and sheets.
 - 1.5 Draw the border lines in drawing sheets following standard rule.
 - 1.6 Draw horizontal, vertical and inclined lines with the help of set squares and T-square.
 - 1.7 Draw 15 degree, 75 degree, 105 degree and 120 degree angles with the help of set squares.
 - 1.8 Use lettering guide, template, scale pantograph and French curve.

LETTERING NUMBERING AND TITLE STRIP

- 2 Letter and number freehand and with instruments.**
 - 2.1 Identify the necessity of good lettering in engineering drawing.
 - 2.2 Draw freehand single stroke vertical letters from A to Z (upper and lower case) and numbers 0 to 9.
 - 2.3 Draw freehand inclined (65 degree to 75 degree) single stroke letters from A to Z (upper and lower case) and numbers from 0 to 9.
 - 2.4 Draw block letters (Gothic) using 5: 4 and 7: 5 proportions and height.
 - 2.5 Select a suitable size of letters and write a few sentences using all the letters selecting suitable scale.
 - 2.6 Draw title strip with proper placement using suitable size of letters and measurements.

ALPHABET OF LINES AND DIMENSIONING

- 3 Adopt the alphabet of lines.**
 - 3.1 Select different lines in drawing.
 - 3.2 Use center line, hidden line, phantom line, break line, dimension line, extension line, section line and cutting plane line.
 - 3.3 Use different thickness of line to emphasize a part of drawing.

- 3.4 Select recommended grades of pencils for various types of lines for engineering drawing.

4 Adopt the elements and theory of dimensioning.

- 4.1 Put dimensions in engineering drawing according to an accepted standard.
- 4.2 Identify the elements of dimensions from a given dimensioned drawing.
- 4.3 Apply aligned and unidirectional system of dimensioning.
- 4.4 Draw size and location of dimension, continuous dimension, staggered dimension and dimensioning in limited space.
- 4.5 Add necessary dimension to a given drawing with suitable arrows.

CONSTRUCTION OF SCALE

5 Prepare scale for drawing application.

- 5.1 Calculate representative fraction and interpret a scale reading.
- 5.2 Use different types of scale to find full size dimension.
- 5.3 Draw a plain scale to show meters, centimeters and millimeters of a given distance on object.
- 5.4 Draw a diagonal scale to show three units having given RF.
- 5.5 Read particular distance on plain and diagonal scale.
- 5.6 Use scale of chord.
- 5.7 Draw angle of 49 degree, 78 degree and 95 degree with the help of scale of chord.

GEOMETRICAL CONSTRUCTIONS & CONIC SECTIONS

6 Construct geometric figures (regular polygons) & Construct conic sections.

- 6.1 Draw regular polygons i.e. pentagon, hexagon and octagon having given one side.
- 6.2 Draw an ellipse by concentric circle method.
- 6.3 Draw an ellipse by parallelogram method.
- 6.4 Draw an ellipse by four center method.
- 6.5 Draw a parabola having given foci and director.
- 6.6 Draw a parabola from given abscissa and ordinate.

SYMBOLS

7 Adopt standard symbols in drawing.

- 7.1 Identify symbols used in drawing.
- 7.2 Draw a legend using symbols of different engineering materials.
- 7.3 Draw the symbols of different plumbing fittings and fixtures used in drawing.
- 7.4 Draw the symbols of different electrical fittings and fixtures used in drawing.
- 7.5 Interpret information from drawing containing standard symbols.

8. Understand the views of engineering drawing.

- 8.1 Identify different types of views
- 8.2 Interpret different types of views

9 Apply the Principles of orthographic projection to a straight line.

- 9.1 Draw the orthographic projection of a straight line under the following conditions : -
 - a) Line parallel to both planes
 - b) Line perpendicular in vertical plane and parallel to horizontal plane
 - c) Line parallel to vertical plane and perpendicular to horizontal plane
 - d) Line inclined at given angle to horizontal plane and parallel to vertical plane
 - e) Line inclined at given angle to vertical plane and parallel to horizontal plane

10 Apply the principles of orthographic projection of rectangular and circular planes (Lamina)

- 10.1 Draw the orthographic projection of rectangular lamina Parallel to both planes.
- 10.2 Draw the orthographic projection of rectangular lamina inclined at given angle to horizontal plane
- 10.3 Draw the orthographic projection of circular lamina parallel to both planes

11 Apply the principles of orthographic projections of geometric solids

- 11.1 Draw the orthographic projection of a cube kept at an angle with one of the planes in first angle method
- 11.2 Draw the orthographic projection of a pyramid kept at an angle with both the planes in 1st angle method
- 11.3 Draw the orthographic projection of a cone kept at an angle with both the planes in third angle method.
- 11.4 Draw the orthographic projection of a prism kept at an angle with vertical plane in third angle method.

ISOMETRIC PROJECTION**12 Understand the importance, use and scope of isometric views in engineering.**

- 12.1 Identify isometric views
- 12.2 Draw the isometric view of rectangular and circular lamina
- 12.3 Draw the isometric projection of solids such as: cube, cylinder, pyramid, prism and steps from different orthographic views
- 12.4 Draw the isometric projection of three deterrent engineering parts from orthographic views

REFERENCE BOOKS

- 1 Geometrical Drawing - I H Morris
- 2 Pratham Engineering Drawing - Hemanta Kumar Bhattacharia
- 3 Civil Engineering Drawing - Guru Charan singh

ELECTRICAL ENGINEERING FUNDAMENTALS

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OBJECTIVES

- To familiarize the basic electrical quantities & laws and to apply them in solving problems of electrical circuits.
- To acquaint with electro-magnetism, electro-magnetic induction.
- To develop skill in electrical wiring.
- To familiarize with DC generator, AC generator, AC motor, DC Motor & Transformers.
- To appreciate the safety measures to be taken for electrical wiring.

SHORT DESCRIPTION

Electric current, Voltage & Resistance; Conductors and insulators; Ohm's law; Kirchhoff's Law; Joule's law; Faraday's law; Basic electrical circuits; Power and energy; Electro-magnetic induction; House wiring; Controlling devices; Protective devices; Earthing; DC Motor, AC Motor, DC Generator; AC Generator; Transformer & Electricity Act/Rule.

DETAIL DESCRIPTION**Theory :****ELECTRIC CURRENT**

- 1 Understand 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 State the units of current, voltage and resistance.

CONDUCTOR, SEMICONDUCTOR & INSULATOR

- 2 Understand conductor semiconductor & insulator.**
 - 2.1 Define conductor, semiconductor and insulator.
 - 2.2 Explain the conductor, semiconductor and insulator according to electron theory.
 - 2.3 List at least 5 conductors, 5 semiconductor and 5 insulators.
 - 2.4 Describe the factors upon which the resistance of a conductor depends.
 - 2.5 State laws of resistance.
 - 2.6 Prove the relation $R = \rho L/A$
 - 2.7 Explain the meaning of resistivity and name the unit of resistivity.
 - 2.8 Solve problems relating to laws of resistance.

OHM'S LAW

- 3 Understand Ohm's Law**
 - 3.1 State Ohm's law.
 - 3.2 Deduce the relation between energy current, voltage and resistance.
 - 3.3 Solve problems relating to Ohm's law.

Principles of [Kirchhoff's Law](#)

- 4 Understand [Kirchhoff's Law](#)**
 - 4.1 State [Kirchhoff's](#) current law.
 - 4.2 Explain the [Kirchhoff's](#) current law.
 - 4.3 Sate [Kirchhoff's](#) Voltage law.
 - 4.4 Explain the [Kirchhoff's](#) Voltage law.

4.5 Solve problem by [Kirchhoff's Law](#)

BASIC ELECTRIC CIRCUITS

5 Understand electric circuit.

- 5.1 Define electric circuit.
- 5.2 Name the different types of electric circuits.
- 5.3 Define series circuit, parallel circuit and mixed circuit.
- 5.4 Describe the characteristic of series circuit and parallel circuit.
- 5.5 Calculate the equivalent resistance of series circuit, parallel circuit.
- 5.6 Solve problems relating to DC series circuit, parallel circuit and mixed circuit.
- 5.7 Define inductor, capacitor, inductive reactance & capacitive reactance.
- 5.8 Write the formula of inductive reactance, capacitive reactance & impedance.
- 5.9 Draw the AC circuit containing resistor, Inductor and Capacitor in Series and parallel circuit.
- 5.10 Problem on AC series & parallel circuit.

POWER AND ENERGY

6 Apply the concept of electrical power and energy.

- 6.1 Define electrical power and energy.
- 6.2 State the unit of electrical power and energy.
- 6.3 Show the relation between electrical power and energy.
- 6.4 Name the instruments for measuring of electrical power and energy.
- 6.5 Draw the connection diagram of wattmeter and energy meter in an electrical circuit.
- 6.6 Solve problems relating to electrical power and energy Calculation.

ELECTRO MAGNETIC INDUCTIONS

7 Understand the principles of Joule's law.

- 7.1 Explain Joule's law regarding the development of heat in electrical circuit.
- 7.2 Describe meaning of "J".
- 7.3 Solve problems relating to Joule's law.

8 Understand the Faraday's laws of Electro-magnetic Inductions

- 8.1 Define Electro-magnetic Inductions.
- 8.2 Explain Faraday's laws of Electro-magnetic Induction.
- 8.3 Solve problems on Electro-magnetic Induction.

WIRES AND CABLES

9 Understand the uses of wires and cables.

- 9.1 Define electrical wires and cables.
- 9.2 Distinguish between wires and cables.
- 9.3 Describe the procedure of measuring the size of wires and cables by wire gauge.

HOUSE WIRING

10 Understand the different methods of house wiring.

- 10.1 State the meaning of wiring.
- 10.2 List the types of wiring.
- 10.3 State the types of wiring used in:
 - a) Residential building.
 - b) Workshop
 - c) Cinema hall/Auditorium
 - d) Temporary shed
- 10.4 List the name of fittings used in different types of electrical wiring.

CONTROLLING & PROTECTIVE DEVICES

11 Understand the controlling and protective devices & use of them.

- 11.1 Define controlling device.
- 11.2 Name the different types of controlling devices.
- 11.3 Define protective devices.
- 11.4 Name the different types of protective devices.
- 11.5 Name the different types of fuses used in house wiring.
- 11.6 Name the different types of circuit breaker used in house wiring.

EARTHING

12 Understand the necessity of earthing.

- 12.1 Define earthing
- 12.2 Explain necessity of earthing
- 12.3 Name different types of earthing

TRANSFORMER

13 Understand the principle of operation of transformer.

- 13.1 Define transformer.
- 13.2 Explain the working principle of transformer.
- 13.3 Write the equation relating to voltage, current & turns of primary & secondary winding of transformer.
- 13.4 Name the different losses of transformer.
- 13.5 Define transformation ratio (voltage, current and turns).
- 13.6 Solve problems on transformation ratio.

DC GENERATOR

14 Understand the principle of DC generator

- 14.1 Define DC Generator.
- 14.2 Classify DC Generator.
- 14.3 Explain the constructional features of DC Generator.
- 14.4 Explain the working principle of DC generator.
- 14.5 Name the different losses of DC Generator.

AC GENERATOR

15 Understand the principle of AC generator

- 15.1 Define AC Generator.
- 15.2 Explain the constructional features of AC Generator.
- 15.3 Explain the Working Principle of AC Generator.
- 15.4 Name the different losses of AC Generator.

DC MOTOR

16 Understand the principle of DC motor.

- 16.1 Define DC motor.
- 16.2 Classify DC Motor.
- 16.3 Name the different parts of DC motor.
- 16.4 Explain the working principle of DC Motor.
- 16.5 Name the different losses of DC Motor.
- 16.6 List the uses of different types of DC Motor.

AC MOTOR

17 Understand the principle of Induction motor.

- 17.1 Define Induction motor.
- 17.2 Classify Induction Motor.

17.3 Describe the principles of operation of capacitor motor.

17.4 List the uses of induction motor.

ELECTRICITY ACT

18 Understand act/rule of Bangladesh and safety practices.

18.1 State electricity act/rule of Bangladesh to be followed in electrical wiring.

18.2 Describe the importance of electricity act/rule.

18.3 Describe safety procedure against electricity hazard.

18.4 List the performance of safety practices for electrical equipment, machines and accessories.

Practical :

1 Identify and use electrical measuring instruments.

1.1 Identify Voltmeters, Ammeters, Clip-on meter, Frequency meter, Wattmeter, Energy meter and AVO meter.

1.2 Select & read the scale of given meters.

1.3 Connect correctly voltmeter, ammeter, wattmeter and energy meter to a given circuit..

2 Show skill in verification of Ohm's Law.

2.1 Sketch the circuit diagram for the verification of Ohm's Law.

2.2 List tools, equipment and material 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.

3 Show skill in verification of Kirchhoff's Law.

3.1 Sketch the circuit diagram for the verification of Kirchhoff's Law.

3.2 List tools, equipment and material 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 Verify the laws by collecting relevant data.

4 Verify the characteristics of series and parallel circuits.

4.1 Draw the working circuit diagram.

4.2 List tools, equipment and materials required for the experiment .

4.3 Prepare the circuit according to the circuit diagram using proper equipment.

4.4 Check all connections before the circuit is energized.

4.5 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.

4.6 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.

5 Show skill in measuring the power of an electric circuit.

5.1 Sketch the necessary circuit diagram of an electrical circuit with electrical load, ammeter, voltmeter and wattmeter.

5.2 Prepare the circuit according to the circuit diagram using ammeter, voltmeter and wattmeter.

5.3 Record the power, measured by the wattmeter and verify the reading with that of calculated from ammeter and voltmeter.

5.4 Compare the measured data with that of calculated and rated power.

- 6 Show skill in measuring the energy consumed in an electrical circuit.**
 6.1 Sketch the necessary diagram of an electric circuit wattmeter, energy meter and electrical load.
 6.2 Prepare the circuit according to the circuit diagram user wattmeter and energy meter.
 6.3 Record the energy measured by the energy meter and verify with that of calculated from wattmeter for a fixed time.
- 7 Show skill in uses of hand tools, wires and cables.**
 7.1 List the hand tools used in electrical wiring.
 7.2 Identify the hand tools used in electrical wiring.
 7.3 Draw neat sketches of hand tools used in electrical wiring.
 7.4 Identify different types of wires and cables.
 7.5 Measure the diameter of the identified wire and cables using standard wire gauge.
- 8 Show skill in preparing wiring circuit of two lamps controlled from two points separately.**
 8.1 Sketch a working circuit of two lamps controlled from two points separately.
 8.2 Make the wiring circuit using required materials and equipment a wiring board.
 8.3 Test the connection of circuit by providing proper supply.
- 9 Show skill in preparing wiring circuit of one lamp controlled from two points.**
 9.1 Sketch a working diagram of one lamp controlled by two SPD tumbler Switches.
 9.2 Complete the wiring circuit using required materials and equipment on wiring board.
 9.3 Test the connection of circuit by providing proper supply.
- 10 Show skill in preparing wiring circuit of one bell with two indicating lamp controlled from two points.**
 10.1 Sketch a working diagram of one bell with two indicating lamps controlled by two push button switch.
 13.2 Make the wiring circuit using required materials and equipment in wiring board.
 13.3 Test the connection of circuit by providing proper supply.
- 11 Show skill in preparing wiring circuit of a fluorescent tube light.**
 11.1 Sketch a working diagram of a fluorescent tube light circuit.
 11.2 Make the connection of a fluorescent tube light circuit using required materials and equipment.
 11.3 Test the connection of the circuit by providing supply.
- 12 Find the transformation ratio of a transformer.**
 12.1 Develop a circuit to perform the experiment.
 12.2 Select required equipment and materials.
 12.3 Connect the components according to the circuit diagram.
 12.4 Check the connections.
 12.5 Record the primary (E_p) and secondary (E_s) voltages.
 12.6 Calculate the transformation ratio using the relation

$$\frac{E_s}{E_p} = \frac{N_s}{N_p} = K$$

 12.7 Note down the observations.
- 13 Dis-assemble and re-assemble the parts of a DC generator/ DC motor.**
 13.1 Select the necessary tools required for dis-assembling and re-assembling the parts of DC generator/ DC motor.
 13.2 Identify at least ten main parts of the generator/motor.

- 13.3 Sketch at least ten main parts of the generator/motor.
- 13.4 Re-assemble the parts of the generator/motor.
- 13.5 Connect the generator/motor to the proper power source.
- 13.6 Start the generator/motor.

14 Start a 1-phase capacitor type motor/ceiling fan with regulator.

- 14.1 Select the equipment and tools required for the experiment.
- 14.2 Sketch a working diagram.
- 14.3 Identify the two sets of coils.
- 14.4 Connect the capacitor with the proper set of coil.
- 14.5 Connect power supply to the fan motor.
- 14.6 Test the rotation of the motor opposite direction by changing the capacitor connection.
- 14.7 Note down the observations.

REFERENCE BOOKS

- | | |
|--|-----------------|
| 1 A text book of Electrical Technology | -B. L. Theraja |
| 2 Basic Electricity | -Charles W Ryan |
| 3 Basic Electrical theory and Practice | -E. B. Babler |
| 4 Electrical Machine | -Siskind |

PHYSICAL EDUCATION AND LIFE SKILL DEVELOPMENT

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OBJECTIVES

- To enhance body fitness.
- To make aware of First Aid Procedure.
- To acquaint with the Common games and sports.
- To develop Life Skill.

SHORT DESCRIPTION

Warm up; Yoga; Muscle developing with equipment; Meditation, First aid; sports science, Games & sports; Life skill development.

DETAIL DESCRIPTION

1. National Anthem and Assembly

- 1.1 Line and File.
- 1.2 Make assembly .
- 1.3 Recitation of national anthem.
- 1.4 National anthem in music.

2. Warm up

2.1 General Warm-up :

Spot running (Slow, Medium & Fast), Neck rotation, Hand rotation, Side twisting, Toe touching, Hip rotation, Ankle twisting, Sit up and Upper body bending (Front & Back).

2.2 Squad Drill :

Line, File, Attention, Stand at easy, Stand easy, Left turn, Right turn, About turn, Mark time, Quick march, Right wheel, Left wheel, Open order march & Closed order march.

2.3 Specific warm up :

Legs raising one by one, Leg raising in slanting position, Knee bending and nose touching, Heels raising, Toes touching (standing and laying position), Hand stretch breathing (Tadasana, Horizontal, Vertical).

2.4 Mass Physical Exercise

Hand raising, Side twisting, Front & back bending, Front curl, Straight arm curl two hand, Hands raising overhead and Push up.

3. Yoga

- 3.1 Dhyanasana : Shabasan, Padmasana, Gomukhasana, Sharbanganasana, shashangasana Shirshasana
- 3.2 Shasthyasana : Halasana, Matshasana, Pabanuktasana, Ustrasana.
- 3.3 Prana and Pranayama: Nadisuddhi Pranayama, cooling pranayamas (sitali pranayama, Sitkari Pramayama, sadanta pranayama), Ujjayi pranayama,

4. Muscle Developing with equipment

- 4.1 Damball : Front curl, Hand sidewise stretching, Arms raising overhead.
- 4.2 Barball : Front press, Leg press, Rowing motion with leverage bar.
- 4.3 Rope climbing : Straight way climbing, Leg raising climbing.
- 4.4 Horizontal bar : Chinning the bar with front grip, Chinning the bar with wide back grip.
- 4.5 Jogging Machine : Slow, Medium, and Fast running.
- 4.6 A. B king pro (Rowing Machine): Sit up.
- 4.7 Sit up bench: Sit up.

5. Meditation

- 5.1 Define meditation.

- 5.2 Classification of Meditation.
- 5.3 Nadanusandhana (A-Kara chanting, U-Kara chanting, M-Kara chanting, AUM-kara chanting).
- 5.4 OM-Meditation.
- 5.5 Cyclic Meditation (Starting Prayer, Instant Relaxation Technique, Centring, Standing Asanas, Sitting Asanas, Quick Relaxation Technique).

6. First Aid

- 6.1 Define First Aid.
- 6.2 What do you mean by First Aider.
- 6.3 Discuss the responsibilities of a First Aider.
- 6.4 Different types of equipment of First Aid.
- 6.5 Muscle Cramp-Ice application (Remedy).
- 6.7 Dislocation-Ice application (Remedy) .

7. Rules and Technique of games and sports

- 7.1 Kabadi.
- 7.2 Football.
- 7.3 Cricket.
- 7.4 Badminton.
- 7.5 Athletics.
- 7.6 Swimming.

8. Sports Science

- 8.1 Definition of Exercise physiology.
- 8.2 Function of muscles.
- 8.3 Concept of work, energy and power.
- 8.4 Effect of exercise on heart and circulatory system.
- 8.5 Motor components for physical fitness.
- 8.6 Definition of sports Biomechanics.
- 8.7 Definition of sports psychology.
- 8.8 Meaning of nutrition, Diet and Balanced diet.
- 8.9 Meaning of the terms –Test, measurement and Evaluation.

9. Show skill on conversation on day to day life

- 9.1 Today's Market price.
- 9.2 Festivals(religious festivals, National festivals).
- 9.3 Celebration of National days.
- 9.4 Aim in life.
- 9.5 Visited historical places/sites.

10. Human relation

- 10.1 Family relation.
- 10.2 Relation with neighbour.
- 10.3 Humanitarian Service.
- 10.4 Service for handicapped (intelligent, physical, social etc).
- 10.5 Service for orphan / Patient.

11 Vote of appreciation

- 11.1 About dress .
- 11.2 For good work.
- 11.3 For good result.
- 11.4 For good news.

12. Stress Management

- 12.1 Habit to be a man of humor.
- 12.2 Always brain should be cool.
- 12.3 Positive thinking.

- 12.4 Factors that determine our attitude.
- 12.5 The benefits of a positive attitude.
- 12.6 Steps to building a positive attitude.

13 Time Management

- 13.1 Determine essential time for a task.
- 13.2 Determine delay and unexpected time.
- 13.3 Determine time for daily activities .
- 13.4 Plan for daily activities.

14 Interview Technique

- 14.1 Mental preparation to face an interview.
- 14.2 Selection of dress for interview.
- 14.3 Introducing himself/herself to the interviewer .
- 14.4 Coping interview.

15 Team work

- 15.1 Organized a team.
- 15.2 Selection of team leader.
- 15.3 Distribution the task to the members.
- 15.4 Accepting opinion of team members.
- 15.5 Completion of task as a team.

16 Social work

- 16.1 Tree plantation.
- 16.2 Community service .
- 16.2.1 Rover Scout.
- 16.2.2 Sanitation.
- 16.2.3 Pure drinking water.
- 16.2.4 Social Culture.

Reference Book

Modern Yoga _Kany Lal Shah

Rules of games and sports_ Kazi Abdul Alim

Yoga _ Sobita Mallick

Iron Man_ Nilmoni Dass

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MATHEMATICS-1

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OBJECTIVES

- To acquaint the students with the basic terminology of Algebra.
- To be able to understand the complex numbers which are being used in electrical engineering.
- To be able to understand the binomial expansion.
- To be able to use the knowledge of trigonometry in solving problems of engineering importance.

SHORT DESCRIPTION

Algebra : AP & GP, Polynomials & polynomial equations, Complex number, Permutation & Combination, Binomial theorem for positive integral index and negative & fractional index.

Trigonometry: Ratio of associated angles, Compound angles, Transformation formulae, multiple angles and Sub-multiple angles.

DETAIL DESCRIPTION

ALGEBRA :

1 Understand the concept of AP & GP.

- 1.1 Define AP and common difference.
- 1.2 Find last term and sum of n terms, given first term and common difference.
- 1.3 Define GP and common ratio.
- 1.4 Find the sum of n terms given first and common ratio.

2 Apply the concept of polynomial in solving the problems.

- 2.1 Define polynomials and polynomial equation.
- 2.2 Explain the roots and co-efficient of polynomial equations.
- 2.3 Find the relation between roots and co-efficient of the polynomial equations.
- 2.4 Determine the roots and their nature of quadratic polynomial equations.
- 2.5 Form the equation when the roots of the quadratic polynomial equations are given.
- 2.6 Find the condition of the common roots of quadratic polynomial equations.
- 2.7 Solve the problems related to the above.

3 Understand the concept of complex numbers.

- 3.1 Define complex numbers.
- 3.2 Perform algebraic operation (addition, subtraction, multiplication, division, square root) with complex number of the form $a + ib$.
- 3.3 Find the cube roots of unity.
- 3.4 Apply the properties of cube root of unity in solving problems.

4 Apply the concept of permutation.

- 4.1 Explain permutation.
- 4.2 Find the number of permutation of n things taken r at a time when,
 - i) things are all different.
 - ii) things are not all different.
- 4.3 Solve problems of the related to permutation :
 - i) be arranged so that the vowels may never be separated. From 10 man and 6 women a committee of 7 is to be formed. In how many ways can this be done so as to include at least two women in the committee.

5 Apply the concept of Combination.

- 5.1 Explain combination.
- 5.2 Find the number of combination of n different things taken r at a time.
- 5.3 Explain nC_r , nC_n , nC_0
- 5.4 Find the number of combination of n things taken r at a time in which p particular things
 - i) Always occur ii) never occur.
- 5.5 Establish i) ${}^nC_r = {}^nC_{n-r}$

$$\text{ii) } {}^nC_r + {}^nC_{r-1} = {}^{n+1}C_r$$

5.6 Solve problems related to combination.

6 Apply partial fraction to break the numerator and denominator.

6.1 Define proper and improper fractions.

6.2 Resolve in to partial fraction of the followings types :

- Denominator having a non-repeated linear factor.
- Denominator having a repeated linear factor.
- Denominator having a quadratic factors.
- Denominator having a combination of repeated, non-repeated and quadratic factors.

7 Apply the concept of binomial theorem.

- State binomial expression.
- Express the binomial theorem for positive index.
- Find the general term, middle term, equidistant term and term independent of x.
- Use binomial theorem to find the value of
 - $(0.9998)^2$, correct to six places of decimal.
 - $(1 + \sqrt{2})^5 - (1 - \sqrt{2})^5$

8 Apply the concept of binomial theorem for negative index.

- Express the binomial theorem for negative and fractional index.
- Solve problems of the following types:

Expand (i) $(1 - nx)^{-\frac{1}{n}}$ (ii) $\frac{1}{\sqrt{4.08}}$

TRIGONOMETRY :

9 Apply the concept of associated angles.

- Define associated angles.
- Find the sign of trigonometrical function in different quadrants.
- Calculate trigonometrical ratios of associated angle.
- Solve the problems using above.

10 Apply the principle of trigonometrical ratios of compound angles.

- Define compound angles.
- Establish the following relation geometrically for acute angles.
 - $\sin(A \pm B) = \sin A \cos B \pm \cos A \sin B$.
 - $\cos(A \pm B) = \cos A \cos B \pm \sin A \sin B$.
- Deduce formula for $\tan(A \pm B)$, $\cot(A \pm B)$.
- Apply the identities to work out the problems:
 - find the value of $\sin 75^\circ$, $\tan 75^\circ$.
 - show that $\frac{\sin 75^\circ + \sin 15^\circ}{\sin 75^\circ - \sin 15^\circ} = \sqrt{3}$
 - if $\alpha + \beta = \theta$, $\tan \alpha + \tan \beta = b$, $\cot \alpha + \cot \beta = a$,
show that $(a - b) = ab \cot \theta$.

11 Apply sum and product formula of trigonometrical ratios.

- Express sum or difference of two sines and cosines as a product and vice-versa
- Solve problems of the followings types:
 - show that, $\sin 55^\circ + \cos 55^\circ = \sqrt{2} \cos 10^\circ$
 - prove that, $\cos 80^\circ \cos 60^\circ \cos 40^\circ \cos 20^\circ = \frac{1}{16}$

12 Apply the concept of ratios of multiple angles.

- State the identities for $\sin 2A$, $\cos 2A$ and $\tan 2A$.
- Deduce formula for $\sin 3A$, $\cos 3A$ and $\tan 3A$.
- Solve the problems of the followings types.
 - express $\cos 5\theta$ in terms of $\cos \theta$.

ii) if $\tan \alpha = 2 \tan \beta$, show that, $\tan (\alpha + \beta) = \frac{3 \sin 2\alpha}{1 + 3 \cos 2\alpha}$

13 Apply the concept of ratios of sub-multiple angles.

13.1 Find mathematically the identities for $\sin \alpha$, $\cos \alpha$ and $\tan \alpha$ in terms of $\frac{\alpha}{2}$ and $\frac{\alpha}{3}$

13.2 Solve the problems of the type :

find the value of $\cos 3^\circ$, $\cos 6^\circ$, $\cos 9^\circ$, $\cos 18^\circ$, $\cos 36^\circ$ etc.

Reference

SL No	Athour	Title	Publication
01	S. P Deshpande	Mathematics for Polytechnic Students	Pune Vidyarthi Graha Prakashan
02	H. K. Das	Mathematics for Polytechnic Students(Volume I)	S.Chand Prakashan
03	Ashim Kumar Saha	Higher Mathematics	Akshar patra Prakashani
04	S.U Ahamed & M A Jabbar	Higher Mathematics	Alpha Prakashani

**Syllabus
Chemistry
Subject Code:**

T P C
3 3 4

Objectives:

1. To understand mole concept and volumetric analysis.
2. To represent the formation of bonds in molecules.
3. Able to select appropriate materials used in construction.
4. Apply knowledge to enhance operative life span of engineering material and structure by various protective methods.

Short Description: Chemistry is a basic science subject which is essential to all engineering courses. It gives knowledge of engineering material, their properties related application and selection of material for engineering application. It is intended to teach student the quality of water and its treatment as per the requirement and selection of various construction materials and their protection by metallic and organic coatings. The topics covered will provide sufficient fundamental as well as background knowledge for the particular branch.

Section - 01 (physical and Inorganic Chemistry)

1. Atomic Structure and Chemical Bond

- 1.1 Definition of Element, atoms, molecules, Fundamental particle of atom, their mass, charge, location.
- 1.2 Definition of atomic number, mass number, Isotope, Isotone and Isobar.
- 1.3 Electronic configuration based on Hunds Rule, Aufbau's principle, Paulis exclusion principle
- 1.4 Definition of atomic weight, equivalent weight of an element, molecular weight, mole in terms of number, mass, volume.
- 1.5 Define symbol, valency and formula.
- 1.6 Explain Chemical bond, octet rule.
- 1.7 Explain Formation of various types of chemical bonds: Covalent, Ionic, Co-ordinate bond.
- 1.8 Explain the bonding along with example CH_4 , H_2 , O_2 , NaCl , MgCl_2 .
- 1.9 Explain Quantum number, Orbit and Orbital.

2. Ionic Equilibrium

- 2.1 Concept of acid, base, salt and types of salts.
- 2.2 pH, pOH, pH scale.
- 2.3 Basicity of an acid and acidity of a base.
- 2.4 Normality, molarity, molality, Volumetric analysis.
- 2.5 Titration and Indicator.
- 2.6 Buffer solution and its mechanism.

3. Chemical reaction, oxidation and reduction.

- 3.1 Define Chemical reaction and explain the various type of chemical reaction.
- 3.2 Explain the full meaning of a chemical equation.
- 3.3 Concept of catalyst.
- 3.4 Modern concept of oxidation and reduction.
- 3.5 Simultaneous Process of Oxidation and Reduction.
- 3.6 Explain the oxidation number.

4. Water Treatment

- 4.1 Concept of hard and soft water
- 4.2 Hardness of water
- 4.3 Describe the softening method of permuted process and ion exchange resin process.
- 4.4 Advantage and Disadvantage of hard water in different industries.
- 4.5 Water treatment plant visit and reporting .

5. Corrosion and Alloy

- 5.1 Types of corrosion.(dry and wet corrosion)
- 5.2 Atmospheric corrosion, Types of atmospheric corrosion and their mechanism, oxide films factors affecting atmospheric corrosion.
- 5.3 electrochemical corrosion, Mechanism of electrochemical corrosion .Types of electrochemical corrosion. Factors affecting electrochemical corrosion.
- 5.4. Protective measures against corrosion: Coating (Galvanic and Zinc, Organic coating coating agents, Electroplating, metal cladding)
- 5.5 Concept of alloy.

Section -2 (Organic Chemistry)

6. Organic Chemistry and Introduction to polymers:

- 6.1 Types of Chemistry.
- 6.2 Catenation property of carbon.
- 6.3 Organic compounds, its properties and applications.
- 6.4 Classification of organic compound by structure and functional group: Define : Homologous series , Alkanes, Alkenes and alkynes; Properties and uses of general formula ; Names and Structure of first five members hydrocarbons .
- 6.5 Polymer, monomer, classification of polymers, Polymerization, addition and condensation polymerization.
- 6.6 Plastics: definition, its types and uses.

Section -3 (Industrial Chemistry)

7. Glass and Ceramic:

- 7.1 Concept of Glass and its constituents, Classification and uses of different glass, elementary idea of manufacturing process of glass.
- 7.2 Introduction to ceramic materials, Its constituent.
- 7.3 Industrial application of glass and ceramic.
- 7.4 Industry visit and reporting.

8. Soap and Detergent:

- 8.1 Introduction – A. Lipid B. Fats and oils
- 8.2 Saponification of fats and oils, Manufacturing of soap.

8.3 Synthetic detergent, types of detergents and its manufacturing.

8.4 Explosives: TNT, RDX, Dynamite.

8.5 Paint and Varnish

8.6 Adhesives.

9. Cement, pulp and papers:

9.1 Concept of cement and its constituents, Classification and uses of different cement, manufacturing process of cement.

9.2 Manufacturing process of pulp and papers.

9.3 Industry visit and reporting.

Section - 4 (Practical Chemistry)

1. Use of laboratory tools and safety measures

2. Observation and measurement :

2.1 Determine the strength of HCl solution using 0.1N Na_2CO_3

2.2 Determine the strength of NaOH by using 0.1N HCl solution.

3. Qualitative analysis of known and unknown salts :

3.1 Identification of known salt (sample Copper, Iron, Aluminum, lead, Ammonium and Zinc salt.)

3.2 Identification of unknown basic radical (e.g. lead, Copper, Iron, Zinc, Aluminum, Ammonium)

3.3 Identification of unknown acid radicals (e.g. Chloride, Nitrate, Sulphate, Carbonate)

Source or Reference Book

1. Higher secondary Chemistry (paper 1st and 2nd)

Writer Dr.Gazi Md.Ahsanul Karim. And Md.Robiul Islam

2. Higher secondary Chemistry (Paper 1st and 2nd)

Writer Dr.Soroj kanti Singha Hazari .

3. An Introduction to Metallic corrosion and its prevention

Writer Raj Narayan.

4. Organic Chemistry

Writer Morrisson and Boyd.

5. Inorganic Chemistry

Writer Ali Haider

SOCIAL SCIENCE

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OBJECTIVE

To provide opportunity to acquire knowledge and understanding on :

- importance of civics and its relationship with other social sciences
- The relationship of an individual with other individuals in a society
- social organizations, state and government
- rule of law, public opinion and political parties
- UNO and its roles
- The basic concepts and principles of economics and human endeavor in the economic system.
- The realities of Bangladesh economy and the current problems confronting the country.
- The role of Diploma Engineers in industries.
- our motherland and its historical background
- good citizenship through practicing our socio- economic culture
- liberation war and its background
- nationalism and life style of the nation

SHORT DESCRIPTION

Civics and Social Sciences; Individual and Society; Nation and Nationality; Citizenship; state and government; Law; Constitution; Government and its organs; public Opinion; Political Party; UNO and its organs;

Scope and importance of Economics; Basic concepts of Economics- Utility, Wealth, Consumption, income wages, salary, value in use and savings; Production – meaning, nature, factors and laws; Demand and Supply; market equilibrium, national income, Current economic problems of Bangladesh; Role of Diploma Engineers in the economic development of Bangladesh; Occupations and career planning; Engineering team.

Part-1 (Civics)

1. Understand the meaning and scope of civics and inter relations of social sciences.

- 1.1 Define civics and social science.
- 1.2 Explain the importance of civics in the personal and social life of an individual.
- 1.3 Describe the relationship of all social science (civics, Economics, political science, Sociology, ethics)

2. Understand the relationship of the individual with the society, Nationality and nation, Rights and duties of a citizen.

- 2.1 Define the concept (individual, society, socialization, Nation, Nationality, citizen and citizenship).
- 2.2 State the relationship among the individuals in the society.
- 2.3 Discuss the methods of acquiring citizenship and state the causes of losing citizenship
- 2.4 Describe the rights of a citizen and state the need for developing good citizenship.

3. Appreciate the relationship between the state and government, law and organs of government.

- 3.1 Meaning the state, government and law
- 3.2 Discuss the elements of state.

- 3.3 Discuss the classification of the forms of government
- 3.4 Distinguish between cabinet form of Government and presidential form of government.
- 3.5 Describe the main organs of Government (legislature, Executive and judiciary)
- 3.6 Discuss the sources of law

4. Understand and the classification of constitution

- 4.1 Define the Constitution.
- 4.2 Explain the deferent form of Constitution
- 4.3 Explain state the salient feature of Bangladesh constitution.
- 4.4 Define the fundamental rights of Bangladesh constitution.
- 4.5 Meaning of human rights.

5. Understand the role of UNO in maintaining world peace

- 5.1 Explain the major functions of UNO.
- 5.2 State the composition and functions of General Assembly.
- 5.3 Describe the Composition and functions of Security Council.
- 6.4 Discuss the role of Bangladesh in the UNO.

6. Understand the role of Ethics values and good governance

- 6.1 Define the values, ethics and good governance.
- 6.2 Discuss the role of government to establish good governance

Part-2 (Economics)

1. Understand the fundamental concepts of economics.

- 1.1 Define the Microeconomics and Macroeconomics.
- 1.2 Discuss the definition of Economics as given by eminent economists.
- 1.3 Describe the importance of economics for Technical Student.
- 1.4 Define commodity, utility, value, wealth, consumption, income, savings, wages, value in use, value in exchange and salary.
- 1.5 Differentiate between value in use and value in exchange.
- 1.6 Explain wealth with its characteristics.

2. Understand the production process and the concept of the law of diminishing returns in the production process.

- 2.1 Discuss production mode and process
- 2.2 Explain the nature of different factors of production.
- 2.3 Discuss production function.
- 2.4 Discuss the law of diminishing returns.
- 2.5 State the application and limitations of the law of diminishing returns.
- 2.6 Describe the law of production (increasing constant and diminishing).

3. Understand the concept of demand, supply and utility.

- 3.1 Define the term, “demand and supply”.
- 3.2 Explain the law of demand and supply .
- 3.3 Draw the demand and supply curve.
- 3.4 Discuss Market equilibrium.
- 3.5 Define the utility, total and marginal utility
- 3.6 Illustrate the law of diminishing utility.
- 3.7 Explain the law of diminishing marginal utility

4. Understand national income.

- 4.1 Define nation income.
- 4.2 Explain how to measure national income.

- 4.3 Discuss GNP, GDP and NNP.
- 4.4 Discuss economic development and growth

5. Understand the current issues and the availability and use of natural resource in the economic development of Bangladesh

- 5.1 Define rural and urban economics.
- 5.2 Identify major problems of rural and urban economy.
- 5.3 Explain the migration of rural population to urban areas.
- 5.4 List of the Natural resource of Bangladesh and classify them according to sources of availability.
- 5.5 Explain the importance of the mine, forest and water resources and potential uses for sustainable development.

6. Role of a Diploma Engineer in the Development of Bangladesh Economy.

- 6.1 Explain the concept of the term, “Engineering team”
- 6.2 Identify the functions of Engineers, Diploma Engineers, craftsmen forming the engineering team.
- 6.3 Discuss the role of a Diploma Engineer in the overall economic development of Bangladesh.
- 6.4 Explain socio-economic status of a diploma Engineer.

Part-3 ((Bangladesh: History& Culture)

সংক্ষিপ্ত বিবরণী

ইতিহাস

- ইতিহাসের সংজ্ঞা ।
 - বাংলাদেশের আবহাওয়া ও অধিবাসী ।
 - বাংলায় ইংরেজ শাসন ক্ষমতালভ ও প্রতিষ্ঠা ।
 - ব্রিটিশ বিরোধী সশস্ত্র প্রতিরোধ আন্দোলন; সংস্কার আন্দোলন ও জাতীয়তাবাদেও বিকাশ এবং বাংলার নবজাগরণ; বঙ্গভঙ্গ ও বঙ্গভঙ্গ উত্তরকালে বাংলার রাজনীতি ও দেশ বিভাগ ।
 - পাকিস্তান আমলে বাংলাদেশ, বঙ্গবন্ধুর নেতৃত্বে বাংলাদেশের মুক্তি সংগ্রাম ও স্বাধীনতালভ ।
- (বিবরণী প্রস্তুত প্রক্রিয়াধীন)

সংস্কৃতি

সংস্কৃতি, সভ্যতার সংজ্ঞা, সংস্কৃতির প্রকরণ, ভাষা আন্দোলন উত্তর বাংলার সংস্কৃতি, স্বাধীনতা উত্তর বাংলাদেশের সংস্কৃতির বিবর্তন, বাংলাদেশের সংস্কৃতিতে প্রত্নতাত্ত্বিক নিদর্শন ও ক্ষুদ্র নৃতাত্ত্বিক গোষ্ঠীসমূহ ।

(বিবরণী প্রস্তুত প্রক্রিয়াধীন)

সহায়ক পুস্তক

হক, মোজাম্মেল “পৌরনীতি” – হাসান বুক হাউস
 প্রফেসর এমাজউদ্দিন “রাষ্ট্রবিজ্ঞান” আজিজিয়া লাইব্রেরী
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রহিম, চৌধুরী, মাহমুদ ও ইসলাম, “বাংলাদেশের ইতিহাস (পরিবর্তিত ও পরিমার্জিত)” ; নওরোজ কিতাবিস্তান, আগস্ট, ১৯৯৯ ।

কে, আলী “বাংলাদেশের ইতিহাস”; আজিজিয়া বুক ডিপো, ২০০১ ।

সিরাজুল ইসলাম, “বাংলাদেশের ইতিহাস-১৭০৪-১৯৭১”; ১ম, ২য় ও ৩য় খন্ড; বাংলাদেশ এশিয়াটিক সোসাইটি, ফেব্রুয়ারি ২০০০ ।

কো-আন্তোনাভা, প্রি, কতোভস্কি, “ভারত বর্ষের ইতিহাস”; প্রগতি প্রকাশন, ১৯৮৮ ।

গোপাল হালদার; “সংস্কৃতির রূপান্তর”; মুক্তধারা, মে ১৯৮৪ ।

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গোপাল হালদার, “বাংলা সাহিত্যের রূপরেখা-১ম ও ২য় খন্ড”; মুক্তধারা,