



BANGLADESH TECHNICAL EDUCATION BOARD

**4-YEAR DIPLOMA-IN-ENGINEERING
PROGRAM**

FOOTWEAR TECHNOLOGY (698)

SYLLABUS

THIRD SEMESTER

Footwear Technology (698) 3rd Semester

Sl No	Sub. Code	Name of the Subject	T	P	C	Marks				Total
						Theory		Practical		
						TC	TF	PC	PF	
1	69831	Footwear Manufacture-II	3	3	4	60	90	25	25	200
2	69832	Material Science – II	3	3	4	60	90	25	25	200
3	66635	Computer Application -II	0	6	2	-	-	50	50	100
4	65931	Mathematics-III	3	3	4	60	90	50	0	200
5	65922	Physics-II	3	3	4	60	90	25	25	200
6	65811	Social Science	3	0	3	60	90	-	-	150
		Total=	15	18	21	300	450	175	125	1050

OBJECTIVES:

1. To be able to identify the different types of leather defects.
2. To familiarize with the properties of shoe upper leather and its quality parts.
3. To acquire knowledge on the measurement of leather and synthetic materials.
4. To develop the knowledge on the leather grading.
5. To acquaint with the calculation of material allowance.
6. To gather knowledge of different types of cutting systems.
7. To develop knowledge and skills on upper leather and synthetic cutting.

SHORT DESCRIPTION:

To understand the quality of different types of upper leather, **defects and leather grading**. Leather grading systems, factors of grading and area measurement. To know the basic principle of consumption, different types of wastes, systems of material allowance calculation, cutting and clicking, systems of cutting, influencing factors, environmental factors, clicking press and their working principle, layout of cutting room, and clicking faults.

Theory

1. Understand the leather defects.
 - 1.1 Define leather defects.
 - 1.2 Mention the name of different leather defects.
 - 1.3 State the causes and effects of leather defects.
2. Understand the leather grading.
 - 2.1 Define cutting **value and** leather grading
 - 2.2 State the reasons of leather grading in shoe factory
 - 2.3 Describe leather grading systems
 - 2.4 Measure the area of leather
 - 2.5 Measure the area of synthetic materials
 - 2.6 State the factors of leather grading
 - 2.7 Calculate the gain or loss after regarding.
3. Understand the material consumption and nesting.
 - 3.1 Define material allowance. State the systems available for material allowance calculation.
 - 3.2 Describe RSM method.
 - 3.3 Describe different types of wastes.
 - 3.4 Explain the factors of material allowance calculation.
 - 3.5 Define nesting.

- 3.6 State the nesting techniques of full grain leather, corrected grain leather and suede leather.
- 3.7 Practice related math
- 4. Understand the basic requirements of cutting**
 - 4.1 Define cutting.
 - 4.2 Define clicking.
 - 4.3 Describe the pre-requisite quality of a cutter.
 - 4.4 State the quality guide line for shoe upper and lining leather cutting.
 - 4.5 State the quality guide line for synthetic materials cutting.
 - 4.6 Describe the environmental factors of cutting room.
 - 4.7 Describe the different types of cutting systems.
 - 4.8 State the cutting process of leather.
 - 4.9 State the cutting process of synthetic materials
 - 4.10 Describe about automatic cutting.
- 5. Understand the hand cutting**
 - 5.1 State the principle of hand cutting.
 - 5.2 Describe the different systems of hand cutting.
 - 5.3 Describe the layout of hand cutting room.
 - 5.4 State the hand tools and equipment used in hand cutting.
 - 5.5 State the hand cutting process.
 - 5.6 Hand cutting technique of full grain, corrected grain and suede leather
 - 5.7 Hand cutting technique of various synthetic upper materials.
 - 5.8 Hand cutting technique of insole, sole, toe puff and counter stiffener.
- 6. Understand the machine cutting**
 - 6.1 State the tools and equipment used in machine cutting.
 - 6.2 State various clicking press knives.
 - 6.3 Describe the storage of knives.
 - 6.4 State the different cutting edges of clicking knives.
 - 6.5 State the modern clicking presses and their working principles.
 - 6.6 Describe the advantages and disadvantages of various types of cutting machines.
 - 6.7 State the press cutting process.
 - 6.8 Mention the safety method of clicking.
 - 6.9 Machine cutting technique of full grain, corrected grain and suede leather.
 - 6.10 Machine cutting technique of various synthetic upper materials.
 - 6.11 Machine cutting technique insole, sole, toe puff and counter stiffener.
 - 6.12 Describe the clicking faults and their remedies.
 - 6.13 Define laser cutting of upper leather.
 - 6.14 Mention the advantages of laser cutting.
 - 6.15 State the procedure of laser cutting of upper leather

PRACTICAL

1. Identify the different leather defects.
2. Determine the cutting value of different leather.
3. Find out the grade of leather.
4. Cut court shoe upper from PU coated fabric by sewing arm clicking machine.
5. Cut derby shoe upper from PVC coated fabric by sewing arm clicking machine.
6. Cut oxford shoe upper from PVC coated fabric by sewing arm clicking machine.
7. Cut court shoe lining from PU coated fabric by sewing arm clicking machine.
8. Cut derby shoe lining from PVC coated fabric by sewing arm clicking machine.
9. Cut oxford shoe lining from PVC coated fabric by sewing arm clicking machine.
10. Cut court shoe upper from aniline finished shoe upper leather by sewing arm clicking machine.
11. Cut derby shoe upper from corrected grain finished shoe upper leather by sewing arm clicking machine.
12. Cut oxford shoe upper from semi-aniline finished shoe upper leather by sewing arm clicking machine.
13. Cut insole for court shoe from synthetic materials by travelling head clicking machine.
14. Cut insole for oxford shoe from synthetic materials by travelling head clicking machine.
15. Cut insole for derby shoe from synthetic materials by travelling head clicking machine.
16. Cut outsole for court shoe from resin rubber by travelling head clicking machine.
17. Cut outsole for derby shoe from crepe rubber by travelling head clicking machine.
18. Cut outsole for oxford shoe from PVC sheet by travelling head clicking machine.
19. Cut heel for court shoe from resin rubber by travelling head clicking machine.
20. Cut heel for derby shoe from crepe rubber by travelling head clicking machine.
21. Cut heel for oxford shoe from PVC sheet by travelling head clicking machine.
22. Cut leather upper by laser cutting machine.

REFERENCE BOOKS

1. Manual of Shoe Making by R.G. Miller
2. Text book of Footwear manufacture by J. H. Thornton.
3. Introduction to the Modern Footwear Technology by B.Venkatappaiah.
4. The art of cutting kid and goat skin by Swayam Siddha, Product Knowledge, FDDI.
5. The art of cutting corrected grain leather by Swayam Siddha, Product Knowledge, FDDI.
6. Clicking handout 1 and 2 by FDDI.
7. Product Knowledge, Cutting, by Swayam Siddha, FDDI.
8. Foot Last Footwear: Structure, types and defects. Noor Mohammad, COEL & LFMEAB, Dhaka.

DETAIL COURSE CONTENT

Objectives

1. To learn the different bottom materials of footwear.
2. To acquire knowledge on insole, sole and heel materials.
3. To develop skill on the identification of different soling materials.
4. To familiarize with needle, thread, abrasive and shoe finishes.
5. To develop knowledge and skill on the selection of needle, thread and finishing materials.

Short description:

Student will learn about the different insole, sole and heel materials, their identification, **properties** and applications. They will be able to select needle and thread according to materials. They will also be able to **select** diversified **materials for** making different types of **footwear**.

Theory:

1. **Understand the natural soling materials**
 - 1.1 Define soling **materials**.
 - 1.2 State the properties of soling materials.
 - 1.3 **Mention the types of natural soling materials.**
 - 1.4 **List out the merit and demerits of leather soling materials.**
 - 1.5 **State the use of jute soling materials.**
 - 1.6 **Mention the merit and demerits of crepe rubber soling materials.**
 - 1.7 Mention the types of soling materials.
 - 1.8 Mention the applications of different soling materials.
2. **Understand the heel**
 - 2.1 Define heel.
 - 2.2 State the different materials for heel.
 - 2.3 Identify wood heels, plastic heels, ABS, EPDM and injection molded heels.
 - 2.4 Select raw materials for different heel manufacturing – injection molded, built up.
3. **Understand the needle**
 - 3.1 Define needle.
 - 3.2 State the various parts of a needle.
 - 3.3 Classify needle according to size and system
 - 3.4 List out the different needle points.
 - 3.5 Show the relationship between needle and thread
 - 3.6 Show the relationship between needle and material.
4. **Understand the natural thread**
 - 4.1 Define thread
 - 4.2 Describe the properties of **natural** threads
 - 4.3 Classify threads
 - 4.4 Identify natural thread- cotton, silk, linen thread.

- 4.5 Explain different thread sizing system
 - 4.6 Illustrate the thread consumption for chain and lock stitch
 - 4.7 Point out different types of thread packaging.
5. **Understand the shoe finishing materials**
- 5.1 Define shoe, cleaner, fillers and primer.
 - 5.2 Point out the properties of cleaners, fillers and polishes.
 - 5.3 State and classify different shoe finishers: cleaners, fillers, polishes, modifiers, renovators
 - 5.4 State about cleaning, repairing, wrinkle chasing and top dressing
 - 5.5 Describe water and solvent based shoe finishes
 - 5.6 Prepare the recipe of brush off, antique and burnished finishing.
6. **Understand the shoe packaging materials**
- 6.1 Define shoe packaging
 - 6.2 State the different materials for shoe packaging
 - 6.3 Mention the properties and dimension of shoe box and cartoon box
 - 6.4 Define shoe stick, shoe tree, stuffing, shoe horn and mention their applications
 - 6.5 State the different moisture absorbing system in shoe box and cartoons

Practical

1. Identify soling materials.
2. Identify leather soles.
3. Identify synthetic soling materials.
4. Identify rubber soles.
5. Identify various polymeric materials for upper, lining and interlining.
6. Identify various reinforcement materials.
7. Identify and select insole materials.
8. Perform the identification of thread materials.
9. Specify needle.

Reference Books:

1. Introduction to the Modern Footwear Technology by Venkatappaiah B.
2. Manual of Shoe Making by R.G. Miller. (Editor)
3. Boot and Shoe Production by JKorn (Editor)
4. Text Book of Footwear Manufacture byJ. H. Thornton
5. Making Shoes by Ruth Thomson
6. Product Knowledge by Swayam Siddha
7. Text Book of Footwear Materials byJ. H. Thornton.
8. An Introduction to the Principles of Leather Manufacture by S.S. Dutta. ILTA, Kolkata Publication.

66635	Computer Application -II	T	P	C
		0	6	2

OBJECTIVES

- To develop skill on spreadsheet applications.
- To develop skill on creating graphs.
- To assist in the efficient use of database packages.
- To develop skill on computerized database management.
- To develop skill on programming with database management.

SHORT DESCRIPTION

Spreadsheet Analysis Package: Applications of spreadsheet; Using worksheet; Apply formula and functions in worksheet; Creating & printing graphs; Create simple macros.

Database management package: Creating the database; Editing the database; Searching the records; Customizing the data entry form; Creating the query; Arranging the records; Generating reports.

Database management language: Creating a command file; Writing simple database program using decision-making commands.

DETAIL DESCRIPTION

SPREAD SHEET ANALYSIS PACKAGE:

- 1 Apply the basic skills of a spreadsheet software package**
 - 1.1 Run a spreadsheet software package.
 - 1.2 Identify and use different areas (working area, border area, control panel, mode indicator, and status indicator) of the worksheet screen.
 - 1.3 Identify the function of different keys (typing key, calculator key, text key, cursor key, etc.) of the keyboard.
 - 1.4 Move around the worksheet using keys and combination of key.
 - 1.5 Identify and use the on-screen help facility.
 - 1.6 Identify and use the types of data, numbers, labels and formula.
 - 1.7 Demonstrate menus, submenus, pop-up menu, etc.
- 2 Manage workbooks and windows.**
 - 2.1 Make and use workbooks.
 - 2.2 Access different types of files.
 - 2.3 Open files as read only.
 - 2.4 Demonstrate the options for saving files.
 - 2.5 Display a workbook in more than one window.
 - 2.6 Work with more one workbook.
 - 2.7 Close a workbook.
 - 3.1 Activate entries in a worksheet.
 - 3.2 Use edit key (F2) to correct or to modify entries.

- 3.3 Activate the command menus and select commands.
 - 3.4 Save the worksheet.
 - 3.5 Exit from spreadsheet.
 - 3.6 Retrieve a previously saved worksheet.
 - 3.7 Modify the worksheet.
 - 3.8 Save a modified worksheet.
- 4 Apply formula, function and using templates.**
- 4.1 Use simple formulae to solve arithmetical computation.
 - 4.2 Use arithmetical operators in formula.
 - 4.3 Edit formula.
 - 4.4 Use mathematical function to solve simple equations.
 - 4.5 Make and use workbook templates.
 - 4.6 Make changes in existing workbook templates
 - 4.7 Validate numbers, dates, times & text.
 - 4.8 Show custom validation.
- 5 Solve engineering problems using formula and functions**
- 5.1 Use mathematical functions to compute trigonometric values, absolute values, random number, square root, logarithmic values, etc for solving engineering problems.
 - 5.2 Use logical functions to perform an operation depending on a condition in engineering problem.
 - 5.3 Use statistical function to compute summation, average, minimum value, maximum value, etc in engineering problem.
- 6 Work with cell pointer to a particular cell.**
- 6.1 Use GOTO key to move the cell pointer to particular cell.
 - 6.2 Use the ABSOLUTE KEY to change cell address from one from to another in formula or in functions.
 - 6.3 Enter range in formulae or in functions by typing directly or by using cell pointer.
 - 6.4 Create a range name.
 - 6.5 Use range name in formula & functions.
 - 6.6 Copy, Move & Erase cell range.
- 7 Format a worksheet.**
- 7.1 Change the width of a column, a range of column, and change the columns width globally.
 - 7.2 Insert blank columns and blank rows in a worksheet.
 - 7.3 Delete columns and blank rows in a worksheet.
 - 7.4 Format the display of data of a worksheet globally or by referring a range of cells (e.g. currency format, exponential format, comma format, etc.).
 - 7.5 Format the display of data and of a worksheet globally or referring of cells.
 - 7.6 Protect worksheet, function, formula, important text and unprotect a range for entering

- 7.7 Work with window for viewing worksheet in different ways and freeze rows or columns.
- 7.8 Create, change and delete a style.

8 Exercise on Sorting, Searching and Worksheet Printing.

- 8.1 Create a database program
- 8.2 Sort a database in different ways.
- 8.3 Search a record from the database using search criteria.
- 8.4 Extract records from the database that match a given criteria.
- 8.5 Delete records that a given criteria from the database using available database commands.
- 8.6 Show the Print Preview and adjust Page setup option.
- 8.7 Create and use page headers of footers.
- 8.8 Set print area, print titles and different print option
- 8.9 Print portion of worksheet and multiple worksheets
- 8.10 Print ranges from different worksheets on the same pages.

9 Create and Print graphs.

- 9.1 Create bar, line, X-Y and pie graphs.
- 9.2 Add color, titles, legend, grid and levels to the graph.
- 9.3 Add visual impact with colors.
- 9.4 Create linked pictures.
- 9.5 Save the graph and assign names to different graphs of a single worksheet.
- 9.6 Print graphs (low or high quality graphs.)
- 9.7 Plot graphs using a plotter using different colors.
- 9.8 Change graphs size, print & plot them.

10 Create Macros and using macro commands.

- 10.1 Create simple macros (e.g. to change the width of a cell, to format a cell display, to erase a range of cells etc.) using keystroke commands.
- 10.2 Create a macro to convert values into labels vice versa.
- 10.3 Create a macro for inserting blank rows between two rows of data in a worksheet.
- 10.4 Create a macro for deleting the inserted blank rows in a worksheet.

DATABASE MANAGEMENT PACKAGE:

11 Create the new database.

- 11.1 Identify the practical database in real world.
- 11.2 Identify the fields and records of a database.
- 11.3 Identify the different phases of database design.
- 11.5 Collect the data form a typical field.
- 11.6 Determine the category of a typical field.
- 11.7 Design a typical Paper- pencil database form raw data.
- 11.8 Run a generalized database management package and

- identify its display Screen
 - 11.9 Identify the different options of the selected packages.
 - 11.10 Use the on-screen help facilities of DBMS package
 - 11.11 Create and save the table structure.
- 12 Change the table structure and edit database.**
- 12.1 Modify and Edit the table structure.
 - 12.2 Verify the structure (i.e. data of update, number of records. etc)
 - 12.3 Enter or append the new records in the database.
 - 12.4 Use the key combinations for editing.
 - 12.5 Use the available options to edit fields.
 - 12.6 Delete unwanted records and files.
 - 12.7 Save & close database file.
 - 12.8 Use different modes to append and edit records of database.
- 13 Search, display and arrange the records of database.**
- 13.1 View a database using list and display command
 - 13.2 Retrieve the database records with different conditions.
 - 13.3 Search within a field.
 - 13.4 Keep the track of specific records.
 - 13.5 Keep the database up-to-date.
 - 13.6 Sort a database on single or multiple fields.
 - 13.7 Sort with qualifier (i.e. sort with specific subset of records).
 - 13.8 Index the database on single or multiple fields.
 - 13.9 Use the function to index on different field types.
 - 13.10 Use the commands for selective indexing and to control the order of records.
- 14 Create the customized data entry form.**
- 14.1 Draw a typical data entry screen with paper-pencil work.
 - 14.2 Design the screen with all fields.
 - 14.3 Move the field to make the entry form logical and easy to use.
 - 14.4 Change the field width.
 - 14.5 Add or delete field (if necessary).
 - 14.6 Change the display characteristics of fields.
 - 14.7 Use picture functions template and range to format the displayed data.
 - 14.8 Use different options and commands in design menu.
 - 14.9 Draw lines and boxes on the form.
- 15 Create the query.**
- 15.1 Display and identify query design screen.
 - 15.2 Build a simple query
 - 15.3 Save & apply the query.
 - 15.4 Use the query design menu options.
 - 15.6 Search the records with matching on two or more fields.
 - 15.7 Select the records within range using range operators.
 - 15.8 Find the records with inexact and complex matching.
 - 15.9 Sort the records within queries.

- 16 Generate the custom reports.**
 - 16.1 Send the reports to the screen or to a file.
 - 16.2 Use the print menu options and dos-prompt options.
 - 16.3 Produce a quick and selective report.
 - 16.4 Plan the design of the report.
 - 16.5 Design a custom columnar report.
 - 16.6 Find the parts of a report specification.
 - 16.7 Make the changes to the report specification.
 - 16.8 Save & run the report.
- 17 Work with multiple database and relationship.**
 - 17.1 Merge the data form one file to another.
 - 17.2 View the files to relate two or more database files.
 - 17.3 Set up the relationship.
 - 17.4 Modify the relationship.
 - 17.5 Create the report from relational database.

DATABASE MANAGEMENT LANGUAGE:

- 18 Create a simple command file using expression and function.**
 - 18.1 Identify the database editor.
 - 18.2 Use the commands to assign different types of data values to variables.
 - 18.3 Save the memory variable.
 - 18.4 Display the memory variable.
 - 18.5 Release & restore the memory variable.
 - 18.6 Use the mathematical expression.
 - 18.7 Use the mathematical, relational, logical and string operators.
 - 18.8 Use the common function such as EOF, BOF DATE, UPPER & LOWER< CTOD, DTOS, SPACE, TRIM, STR, etc. in command file.
 - 18.9 Use the commonly use commands such as SET TALK, SKIP, RETURN in command file.
 - 18.10 Use the commands to display a string of characters and wait for user response.
 - 18.11 Use commands to display or print text.
- 19 Design & write simple programs.**
 - 19.1 Identify the basic steps to design a program.
 - 19.2 Write the pseudo code for simple program.
 - 19.3 Convert the pseudo code into actual program code.
 - 19.4 Verify & documents the simple program.
 - 19.5 Save the command file and then exit.
 - 19.6 Run the program.
- 20. Use DO WHILE ---- ENDDO, IF ---- ENDIF and DO CASE ---- ENDCASE to control program flow.**
 - 20.1 Use SCAN ---- ENDSCAN command instead of DO WHILE -- -- ENDDO.

- 20.2 Use IF, ELSE and ENDIF commands to branch to the part the program.
- 20.3 Use nested IF ---- ENDIF statements.
- 20.4 Write simple program using decision making commands.
- 20.5 Use immediate IF function.
- 20.6 Write simple program using immediate IF functions.
- 20.7 Use CASE ---- ENDCASE statement instead more than three IF ---- ENDIF statements.
- 20.8 Use the EXIT, CANCEL, WAIT and ZAP command in database program.
- 20.9 Use macro function within programs.

AIMS

- To make understand the basic concept and techniques of composition and resolution of vectors and computing the resultant of vectors.
- To enable to use the knowledge of gradient of a straight line in finding speed, acceleration etc.
- To enable to use the knowledge of conic in finding the girder of a railway bridge, cable of a suspension bridge and maximum height of an arch.
- 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

Vector	: Addition and subtraction dot and cross product.
Co-ordinate Geometry	: Co-ordinates of a point, locus and its equation, Straight lines, circles and conic.
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**Vector**

- 1 Apply the theorems of vector algebra.**
 - 1.1 Define scalar and vector.
 - 1.2 Explain null vector, free vector, like vector, equal vector, collinear vector, unit vector, position vector, addition and subtraction of vectors, linear combination, direction cosines and direction ratios, dependent and independent vectors, scalar fields and vector field.
 - 1.3 Prove the laws of vector algebra.
 - 1.4 Resolve a vector in space along three mutually perpendicular directions
 - 1.5 solve problems involving addition and subtraction of vectors.
- 2 Apply the concept of dot product and cross product of vectors.**
 - 2.1 Define dot product and cross product of vectors.

- 2.2 Interpret dot product and cross product of vector geometrically.
- 2.3 Deduce the condition of parallelism and perpendicularity of two vectors.
- 2.4 Prove the distributive law of dot product and cross product of vector.
- 2.5 Explain the scalar triple product and vector triple product.
- 2.6 Solve problems involving dot product and cross product.

CO-ORDINATE GEOMETRY

3 Apply the concept of co-ordinates to find lengths and areas.

- 3.1 Explain the co-ordinates of a point.
- 3.2 State different types of co-ordinates of a point.
- 3.3 Find the distance between two points (x_1, y_1) and (x_2, y_2) .
- 3.4 Find the co-ordinates of a point which divides the straight line joining two points in certain ratio.
- 3.5 Find the area of a triangle whose vertices are given.
- 3.6 Solve problems related to co-ordinates of points and distance formula.

4 Apply the concept of locus.

- 4.1 Define locus of a point.
- 4.2 Find the locus of a point.
- 4.3 Solve problems for finding locus of a point under certain conditions.

5 Apply the equation of straight lines in calculating various parameter.

- 5.1 Describe the equation $x=a$ and $y=b$ and slope of a straight line.
- 5.2 Find the slope of a straight line passing through two point (x_1, y_1) and (x_2, y_2) .
- 5.3 Find the equation of straight lines:
 - i) Point slope form.
 - ii) Slope intercepts form.
 - iii) Two points form.
 - iv) Intercept form.
 - v) Perpendicular form.
- 5.4 Find the point of intersection of two given straight lines.
- 5.5 Find the angle between two given straight lines.
- 5.6 Find the condition of parallelism and perpendicularity of two given straight lines.
- 5.7 Find the distances of a point from a line.

6 Apply the equations of circle, tangent and normal in solving problems.

- 6.1 Define circle, center and radius.
- 6.2 Find the equation of a circle in the form:
 - i) $x^2 + y^2 = a^2$
 - ii) $(x - h)^2 + (y - k)^2 = a^2$
 - iii) $x^2 + y^2 + 2gx + 2fy + c = 0$
- 6.3 Find the equation of a circle described on the line joining (x_1, y_1) and (x_2, y_2) .
- 6.4 Define tangent and normal.
- 6.5 Find the condition that a straight line may touch a circle.

- 6.6 Find the equations of tangent and normal to a circle at any point.
- 6.7 Solve the problems related to equations of circle, tangent and normal.
- 7. **Understand conic or conic sections.**
 - 7.1 Define conic, focus, directrix and eccentricity.
 - 7.2 Find the equations of parabola, ellipse and hyperbola.
 - 7.3 Solve problems related to parabola, ellipse and hyperbola.

DIFFERENTIAL CALCULUS

FUNCTION AND LIMIT

8. Understand the concept of functions and limits.

- 8.1 Define constant, variable, function, domain, range and continuity of a function.
- 8.2 Define limit of a function
- 8.3 Distinguish between $f(x)$ and $f(a)$.

8.4 Establish

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

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

9. Understand differential co-efficient and differentiation.

9.1 Define differential co-efficient in the form of

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

- 9.2 Find the differential co-efficient of algebraic and trigonometrically functions from first principle.

10. Apply the concept of differentiation.

- 10.1 State the formulae for differentiation:

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

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

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

Apply the concept of geometrical meaning of dy/dx

- 11.1 Interpret dy/dx geometrically.
- 11.2 Explain dy/dx under different conditions
- 11.3 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?

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

- 12.1 Find 2nd, 3rd and 4th derivatives of a function and hence find n-th derivatives.
- 12.2 Express Leibnitz's theorem
- 12.3 Solve the problems of successive differentiation and Leibnitz's theorem.

13 Understand partial differentiation.

- 13.1 Define partial derivatives.
- 13.2 State formula for total differential.
- 13.3 State formulae for partial differentiation of implicit function and homogenous function.
- 13.4 State Euler's theorem on homogeneous function.
- 13.5 Solve the problems of partial derivatives.

INTEGRAL CALCULUS

14 Apply fundamental indefinite integrals in solving problems.

- 14.1 Explain the concept of integration and constant of integration.
- 14.2 State fundamental and standard integrals.
- 14.3 Write down formulae for:
 - i) Integration of algebraic sum.
 - ii) Integration of the product of a constant and a function.
- 14.4 Integrate by method of substitution, integrate by parts and by partial fractions.
- 14.5 Solve problems of indefinite integration.

15 Apply the concept of definite integrals.

- 15.1 Explain definite integration.
- 15.2 Interpret geometrically the meaning of $\int_a^b f(x) dx$
- 15.3 Solve problems of the following types:

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

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PHYSICS-II

T	P	C
3	3	4

AIMS

- To provide a foundation in scientific principles and processes for the understanding and application of technology.
- To develop an understanding of fundamental scientific concepts through investigation and experimentation.
- To provide a common base for further studies in technology and science.
- To develop the basic knowledge of modern physics.

Short description

Thermometry; Calorimetry, Expansion of materials (effect of heat); Heat transfer; Nature of heat and its mechanical equivalent; Engine. Principles of light and Photometry; Reflection of light; Refraction of light ; lens. Concept of Electron and photon; structure of atom, Theory of Relativity.

Detail description

Theory :

1. Thermometry

- 1.1 Define heat and temperature.
- 1.2 Mention the units of measurement of heat and temperature.
- 1.3 Distinguish between heat and temperature.
- 1.4 Identify the sources of heat.
- 1.5 Identify the range of the Celsius scale determined by the boiling point and melting point of water
- 1.6 Compare the Celsius scale, Roamer scale, Fahrenheit scale, Kelvin scale and Rankin scale of temperature measurement.
- 1.7 State the construction and graduation of a mercury thermometer.
- 1.8 Describe the operation of different types of thermometers (e.g., maximum and minimum thermometer, clinical thermometer).

2. Heat capacity of materials (calorimetric)

- 2.1 State the heat as a form of energy.
- 2.2 Define specific heat capacity.
- 2.3 State SI units of measurement of specific heat capacity as J/Kgc^0 or J/Kgk^0 .
- 2.4 Define thermal capacity and water equivalent.
- 2.5 Differentiate between thermal capacity and water equivalent.
- 2.6 Mention the specific heat capacity of different materials.
- 2.7 Prove the total heat gained by an object is equal to the sum of the heat lost by all the surrounding objects.

- 2.8.1 Identify specific latent heat as the energy consumed or liberated when water vaporizes or condenses and when ice melts or freezes.
- 2.8.2 Explain the effects of a change in pressure on the melting point and boiling point of water.
- 2.9 Define various kinds of specific latent heat.
- 2.9.1 Determine the latent heat of fusion of ice and latent heat of vaporization of water.

3. Effects of heat on dimension of materials

- 3.1 Show that different materials change in size at different amounts with the same heat source.
- 3.2 Explain the meaning of differential expansion in bimetallic strip, thermostats, compensated pendulum etc.
- 3.3 Explain the methods of overcoming problems caused by the expansion of materials in buildings, machinery, railway lines and bridges.
- 3.4 Define the co-efficient of linear, superficial and cubical expansion of solids.
- 3.5 Mention the units co-efficient of linear, superficial and cubical expansion of solids.
- 3.6 Mention the linear, Superficial and cubical expansion of a range of common engineering materials.
- 3.7 Define real and apparent expansion of liquid.
- 3.8 Define and explain the co-efficient of real and apparent expansion of liquid.
- 3.9 Distinguish between the co-efficient of real and apparent expansion of liquid.
- 3.10 Determine the co-efficient of real and apparent expansion of liquid.

4. Heat transfer

- 4.1 Identify the phenomenon of heat transferring from hot bodies to cold bodies.
- 4.2 Explain the methods of heat transfer by conduction, convection and radiation with examples of each type of transfer.
- 4.3 Define thermal conductivity (K) & rate of heat transfer.

State the SI units of thermal conductivity as $\frac{W}{m \cdot K}$ or $\frac{W}{m \cdot ^\circ C}$

- 4.4 List the factors which determine the quantity of heat (Q) flowing through a material.
- 4.5 Show that the quantity of heat flowing through a material can be found from $Q = \frac{KA(\theta_H - \theta_C)t}{d}$
- 4.6 Outline the properties of materials which give thermal insulation.
- 4.7 Explain Characteristics of radiant heat energy.
- 4.9 State Stefan-Boltzman Law,

- 4.10 State Newton's law of cooling.
- 4.11 State Wien's law.
- 4.12 Explain Green house effect.

5. Nature of heat and its mechanical equivalent

- 5.1 Describe the caloric theory and kinetic theory of heat.
- 5.2 State the drawbacks of the caloric theory of heat.
- 5.3 Explain the mechanical equivalent of heat.
- 5.4 Explain the first law of thermodynamics .
- 5.5 Explain Isothermal and adiabatic change.
- 5.6 Explain Specific heat of a gas, Molar specific heat or molar heat capacity.
- 5.7 Relate between pressure and volume of a gas in adiabatic Change i, e; $PV^\gamma = \text{const.}$
- 5.8 Difference between C_p and C_v for an ideal gas ($C_p - C_v = R$)

6. 2nd law of thermodynamics

- 6.1 State and Explain Reversible process and irreversible process.
- 6.2 State & explain 2nd law of thermodynamics
- 6.3 Explain heat engine.
- 6.4 Explain the principle of work of a heat engine.
- 6.5 Identify thermal efficiency of a heat engine.
- 6.6 Explain the working principles of internal combustion and external combustion engines (with fair sketches)
- 6.7 Distinguish between internal combustion engine and external combustion engine. Entropy : Definition, unit and significant.
- 6.8 Explain Change of entropy in a reversible and irreversible process.
- 6.9 Give an example of increase of entropy in irreversible process.

7. Preliminaries of light and photometry

- 7.1 Define light, medium (transparent, translucent, opaque), luminous & non-luminous bodies, parallel, convergent & divergent rays, beam.
- 7.2 Show the travel of light in straight line.
- 7.3 Define photometry, luminous intensity, luminous flux, brightness and illuminating power.
- 7.4 Mention the units of luminous intensity, luminous flux, brightness and illuminating power.
- 7.5 Mention relation between luminous intensity & illuminating power.
- 7.7 Describe the practical uses of light waves in engineering.

8. Reflection of light

- 8.1 Define mirror (plane & spherical), image (real & virtual) and magnification of images.
- 8.2 Describe the reflection of light.
- 8.3 State the laws of reflection of light.
- 8.4 Express the verification of laws of reflection.

- 8.5 Define pole, principal axis, center of curvature, radius of curvature, principal focus in case of concave & convex mirrors.
- 8.6 Find the relation between focal length & radius of curvature of a concave & convex mirror.
- 8.7 Express the general equation of concave and convex mirror.

9. refraction of light

- 9.1 Define refraction of light Give examples of refraction of light
- 9.2 State the laws of refraction and Express the verification of laws of refraction
- 9.3 Define absolute and relative refractive index and Relate absolute and relative refractive index
- 9.4 Explain the meaning of total internal reflection and critical angle and Relate total internal reflection and critical angle.
- 9.5 Give examples of total internal reflection.
- 9.6 Describe refraction of light through a prism.
- 9.7 Express the deduction of the relation between refractive index, minimum deviation and angle of the prism.
- 9.8 Explain Dispersion of light.
- 9.9 Define lens and mention the kinds of lens.
- 9.10 Define center of curvature, radius of curvature, principal axis, 1st and 2nd Principal focus, optical center and power of lens.
- 9.11 Express the deduction of the general equation of lens (concave & convex).
- 9.12 Define Combination of two thin lenses and equivalent lens.
- 9.13 Identify and List uses of lens.

10. Electron and photon :

- 10.1 Describe Electrical conductivity of gases.
- 10.2 Describe Discharge tube.
- 10.3 Cathode ray : Definition and its properties
- 10.4 X-ray : Definition, properties & uses
- 10.5 Discuss Photo electric effect.
- 10.6 Derive Einstein's photo electric equation

11. Structure of atom :

- 11.1 Atomic models: Thomson, Rutherford and Bohr model.
- 11.2 Bohr Hydrogen atom & the theory of hydrogen spectra .
- 11.3 Define and explain Radio activity.
- 11.4 Describe Radioactive rays.
- 11.5 Deduce radioactive decay law.
- 11.6 Define half-life & mean life of radioactive atoms.
- 11.7 Define nuclear fission & fusion.

12. Theory of relativity :

- 12.1 Express the theory of relativity.
- 12.2 Mention different Kinds of theory of relativity.

12.3 Explain special theory of relativity and its fundamental postulate.

12.4 Deduce Einstein's mass -energy relation

Practical:

1. Compare the operation of common thermometers.
2. Determine the co-efficient of linear expansion of a solid by Pullinger's apparatus.
3. Measure the specific heat capacity of various substances(Brass, steel).
4. Determine the latent heat of fusion of ice.
5. Determine the water equivalent by calorimeter.
6. Compare the luminous intensity of two different light sources.
7. Verify the laws of reflection.
8. Find out the focal length of a concave mirror.
9. Determine the refractive index of a glass Slab.
10. Determine the angle of Minimum deviation and refractive index of a glass prism by using I-D graph.

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Social science

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OBJECTIVES

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.
- occupations and career planning for Diploma Engineers.

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 and salary and savings; Production – meaning, nature, factors and laws; Demand and Supply; 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 social science.
 - 1.2. State the meaning and scope of civics.
 - 1.3. Explain the importance of civics in the personal and social life of an individual.
 - 1.4. 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, Nation, Nationality, citizen and citizenship).
 - 2.2 State the relationship among the individuals in the society.
 - 2.3 Differentiate between nation and nationality.
 - 2.4 Describe the elements of nationality
 - 2.5 Describe the criteria of Bangladesh nationalism.
 - 2.6 Differentiate between a citizen and an alien.
 - 2.7 Discuss the methods of acquiring citizenship and state the causes of losing citizenship

- 2.8 Describe the rights of a citizen and state the need for developing good citizenship.
8. 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
9. Understand and the classification of constitution
 - 4.1 Explain the deferent form of Constitution
 - 4.2 Explain the merits and demerits of different forms of constitution and state the salient feature of Bangladesh constitution
10. Understand the importance of the formation of public opinion and the role of political parties in the affairs of state and government.
 - 5.1 Define the public Opinion and political party.
 - 5.2 Explain the importance of public opinion in the modern democratic society.
 - 5.3 Discuss the role of different media in forming public opinion.
 - 5.4 Discuss the importance of political parties in democracy.
6. Understand the role of UNO in maintaining world peace
 - 6.1 Explain the major functions of UNO.
 - 6.2 State the composition and functions of General Assembly.
 - 6.3 Describe the Composition and functions of security council.
 - 6.4 Discuss the role of Bangladesh in the UNO.

Part-2 (Economics)

1. Understand the importance of the study fundamental concepts of economics.
 - 1.1 Discuss the definition of Economics as given by eminent economists.
 - 1.2 Describe the scope and importance of economics of Technical Student.
 - 1.3 Define commodity, utility, value, wealth, consumption, income, savings wages and salary.
 - 1.4 Differentiate between value in use and value in exchange.
 - 1.5 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 the law of diminishing returns.
 - 2.4 State the application and limitations of the law of diminishing returns.
 - 2.5 Describe the law of production (increasing constant and diminishing).

3. Appreciate the importance of the concept of elasticity of demand.
 - 3.1 Illustrate the law of diminishing utility.
 - 3.2 Define the marginal utility explain the law of dismissing marginal utility.
 - 3.3 define the term, “demand”
 - 3.4 Describe elasticity of demand and factors which determine the elasticity of demand
 - 3.5 Describe elasticity of supply with the help a supply curve.

4. Understand national income and population control.
 - 4.1 Explain national income.
 - 4.2 Discuss GDP and GNP.
 - 4.3 Discuss growth rates.
 - 4.4 Explain features of Bangladesh population.
 - 4.5 State measures to be undertaken to arrest high growth rate of population.

5. Understand the current issues and the availability and use of natural resource in the economic development of Bangladesh
 - 5.1 Identify major problems of rural and urban economy.
 - 5.2 Explain income distribution in alleviating poverty in equality and discrimination.
 - 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. Understand the 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.

7. Appreciate the career prospects for Diploma Engineers in different production/service engineering organizations.
 - 7.1 Explain the employment opportunities for diploma engineers in different sectors and sub Sectors of economy
 - 7.2 Explain socio-economic status of a diploma Engineer.
 - 7.3 Explain prospects of diploma Engineers in self-employment.