Bachelor of Technical Education (B Tech Ed)

(Civil Engineering)

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Approved by

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Bachelor of Technical Education (B. Tech. Ed.) Program: Program Context

Technical and Vocational Education and Training (TVET) has been one of the prominent sectors globally for a long. Dewey (1916) saw TVET as a tool for education reform in modernizing society. This has been equally vibrant in the present context as scholars (e.g. Maclean & Wilson, 2009) argue that TVET is an education and training that prepares an individual for gainful employment. TVET programs equip young people with the skills, knowledge, and competencies required to enter a particular type of professional career (OECD 2017). Hence, the role of TVET in preparing skilled human resources and enabling them to transition into the career path for gainful employment in specific and the country's economic development in a broad is inevitable.

Background

The formal TVET began in Nepal only around mid of the 20th century. Nevertheless, occupational skills have been transformed from generation to generation for a long (Ministry of Education [MoE], 2012). The establishment of the Council for Technical Education and Vocational Training (CTEVT), the governing body of TVET in 1989, was a substantive effort toward its development and expansion (CTEVT, 2019). Additionally, at present, the Centre for Education and Human Resource Development (CEHRD) offering technical diplomas in 284 technical stream schools throughout the country (GoN, 2018) and universities (such as Kathmandu University, Manmohan Technical University, etc.) run bachelor and master in TVET and other 11 federal ministries offer TVET related formal and non-formal programs (MoEST, 2019).

The CTEVT, which is in charge of formulating TVET-relevant policies, developing standards for programs and curriculums, coordination, accreditation, monitoring, and supervision (CTEVT, 2019) largely shares the TVET related activities. There are 1131 CTEVT affiliated and constituent institutions with roughly the average capacity of 70,000 per annual operate formal TVET programs (CTEVT, 2020). Further expansion of TVET institutions in the country is yet to be expected soon since the government has a provision of establishing at least one technical school in all local levels.

The Gap

The existing human resource related to TVET is insufficient. For example, there are 932 permanent employees in CTEVT to manage, implement, and regulate 31 programs in about 1500 constituent and affiliated Polytechnics (technical schools), community schools, and private institutions across the country (CTEVT, 2019). Of course, this figure of institutions will surge shortly with

mushrooming TVET schools as the establishment has begun from provincial and local governments, especially after the federal restructure. The CTEVT constituent Polytechnics have only a few permanent instructors, while most other required are hired on a temporary and contract basis. Community schools running CEHRD technical programs are provisioned for 2 to 4 teachers; however, a permanent teacher has not been recruited. This shows most of the instructors in the technical schools are hired as per the needs and such instructors are very less or without pedagogical knowledge on the respective subject as the instructors are from a technical background such as engineering, agriculture, technology, etc that do not necessarily cover the pedagogical aspect. This scarcity of teachers in technical schools of Nepal is also anticipated in School Sector Development Programme (SSDP) (2016), which aimed at preparing 998 specialized teachers by 2021 in the technical subjects. Insufficient of specialized teachers in technical schools yet to be seen in the days to come with the government's current policy of establishment of at least one TVET school at all local levels and increasing share of students' enrolment from about 15% of the present situation to 70% of total student in secondary level education (MOEST, 2019).

The education policy (2019) envisions access to TVET education for all. However, this is only possible when competent and specialized teachers are available for different technical programs in Nepal. The existing human resource shows technical schools have a severe lack of specialized teachers. There needs immediate action for preparing competent teachers to enhance the quality of technical education in all governments.

Bachelor of Technical Education (B Tech Ed) of Kathmandu University is the only program that prepares teachers in technical and vocational education and training in Nepal. B Tech Ed is a pioneer bachelor program and implemented by Technical Institute for Technical Instructors (TITI). The program aims at preparing instructors, teachers, or trainers in technical subjects (TITI, 2021). The expansion of the B Tech Ed program will be a milestone if it fulfils teachers' demands in technical schools, which has been a profound lack with a constant increase in the TVET institutions/programs.

The TVET programs are primarily in the secondary level education, and an instructor is required to have a minimum bachelor degree educational qualification. BTech, one of the innovative programs started realizing the need for technical human resources in Nepal to meet such requirements. The Program equips a student with a different technical background with classroom instruction or pedagogical aspects in their specialized subjects. The Program is run by TITI with the expectation that it would fulfill the need of the technical schools across the country. However, at the existing pace, fulfilling the requirement would be almost impossible since every year roughly 10 students are graduated from the Program. Nonetheless, this program would be supportive to the local government and provincial governments if the program is expanded and more students are graduated. In this regard, its immediate expansion is necessary for the decentralized context. For

this, the collaboration with relevant stakeholders, in all level of governments need to be established so that it will on the one hand support preparing good instructors, on the other hand, sustain the TVET programs with the engagement of quality teachers.

In the federal context, it would be rational to run the Program in a decentralized manner**.** Running a TVET program is costly, in this sense, it might be difficult to generate resources for huge investments across the country. In this respect, the university can collaborate with the relevant stakeholders such as polytechnic, private sectors, etc. preparing the teachers which may have already well-functioning labs and infrastructure in all provinces or even in the local governments. It would be also an opportunity for the university to fulfill the demand that it can develop its lab according to trade-specific occupation and that would be a contribution to preparing competent teachers/instructors in a decentralized context.

The Bachelor of Technical Education (B. Tech. Ed.) Program

The purpose of the Bachelor of Technical Education (B. Tech. Ed.) is to prepare individuals for careers in the private and public sector at the level of instructor, teacher, trainer, or professionals in technical and vocational education subject areas.

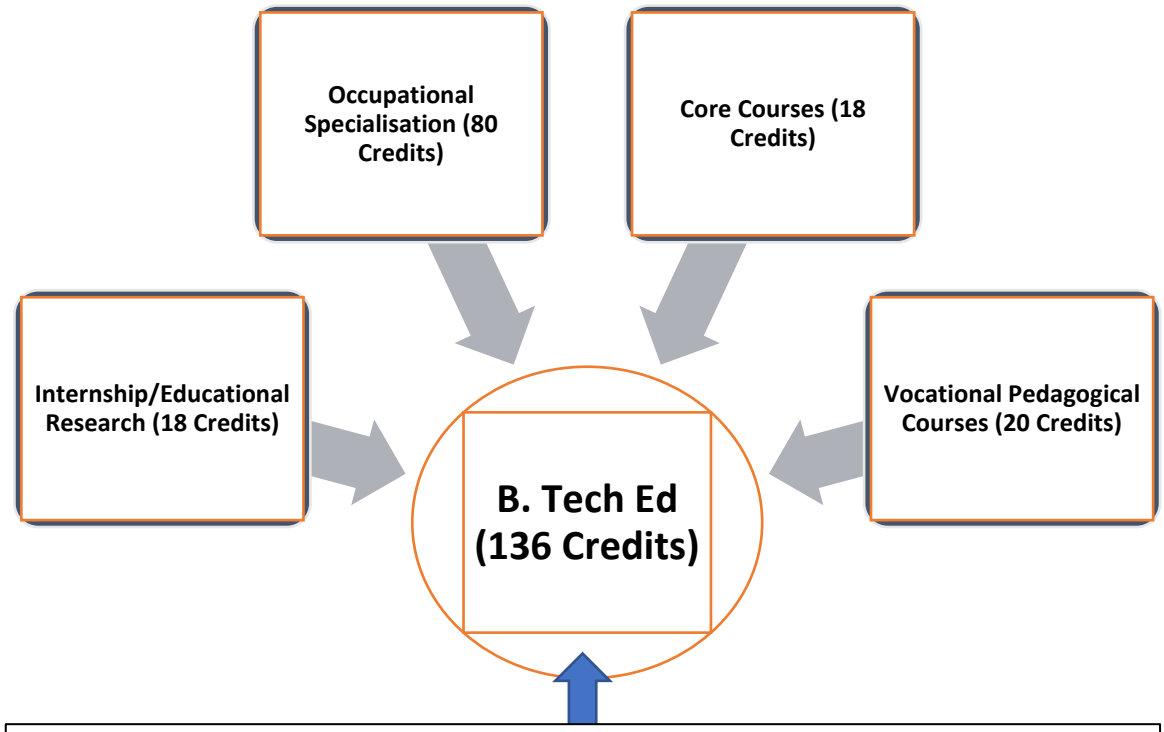
The following are the aims of the program:

1. Demonstrate Level 6 competencies envisaged by the National Vocational Qualification Framework (NVQF) of Nepal,
2. Exhibit comprehensive, meaningful, and coherent knowledge and skills in any of the specific fields in technical-vocational occupational specialization e.g., civil, mechanical, computer, agriculture, etc,
3. Apply occupational specialization knowledge and skills in solving problems occurred in their contexts of work,
4. Apply vocational pedagogical knowledge and skills in any of the specific fields in technical and vocational instruction,
5. Show scholarly literacy, communication, quantitative reasoning, critical thinking, learning skills needed for advanced learning,
6. Exemplify a deep and principled understanding of the technical and vocational learning processes and the role of the instructors in facilitating these processes in the students,
7. Show a sound understanding of how educational processes relate to larger historical, social, cultural, and political processes,
8. Apply a wide range of teaching process skills including curriculum development, lesson planning, materials development, assessment, and pedagogical approaches, and
9. Reflect on the relationship between teaching and learning, content and pedagogy, work and learning, thereby embracing lifelong learning in their roles as the technical and vocational instructors

The Program has been divided into eight semesters. The total credit hours of the Program are 136. At the end of each semester, there will be a semester assessment. However, according to Kathmandu University rule, the total duration to complete the Program must not exceed seven years.

Normally, graduates of the B Tech Ed Program are eligible for master-level studies (equivalent to Level 7) in technical and vocational education, teacher education, general management, technology management, educational leadership, TVET management, rural technology, to name but a few.

Bachelor of Technical Education
Program Structure



Eligibility

Level 5 educational qualification (as per NVQF) acquired

Entry Requirements

The minimum prerequisite for this program is the completion of Level 5 education in relevant vocational specializations. The details are-

- PCL equivalent diploma or an intermediate in a technical subject (≥ 2nd division) from a recognized institute with SLC (≥ 2nd division); or
- A two-year technician certificate (≥ 50%) from a recognized institute with SLC (≥ 2nd division); or
- An intermediate level in a technical subject (≥ 2nd division) from a recognized institute with TSLC (≥ 50%);
- A 2-year technician certificate from a recognized institute (≥ 50%) with TSLC (≥ 50%); or
- 10+2 or equivalent (SLCE after 2016) with sufficient background/experience for the area of vocational specialization.

General Educational Knowledge test (oral and written): This is a written objective test to assess the applicant's knowledge in Mathematics, Science, and English corresponding to intermediate/10+2/diploma levels. Those who secure 50% can be eligible for the study.

Oral/Occupational assessment (test): This assessment focuses on the applicant's aptitude, related work experience, career goals, personal presentation skills, and financial support. Those who secure 50% will qualify for the study.

Core Courses (18 Credit Hours = 12 TH + 6 PR)

SN	Courses	Credit Hours	Theory	Practical
1.	EDUC 100 The Teaching Profession	3	2	1
2.	ENGT 100 General English	3	2	1
3.	EDUC 200 Educational Psychology	3	2	1
4.	NEPL 200 General Nepali	3	2	1
5.	EDUC 300 Curriculum Development	3	2	1
6.	EDUC 301 Measurement and Evaluation	3	2	1
Total		18	12	6

EDUC = Education, COME = Communication English, COMN = Communication Nepali

CORE Course Outline for Semester 1

Course**:** The Teaching Profession | Code: EDUC 100

Credit Hours: 3 | Nature: Theory and Practical

Course Description

Teaching is a noble profession through which teachers facilitate students' learning to construct knowledge and develop skills to meet the goals of education. A teacher inspires and empowers students through the proper use of 'Hand, Heart and Mind'. For this, a teacher needs to develop professional knowledge and skills through experience and formal education. One of the essential features among teachers is that they should be acquainted with different philosophical orientations of teaching professions to develop their professions as per the demanding need of the local and global contexts and develop their better version. In this context, this course is designed to illustrate the various evolution of the teaching profession in different cultures and civilizations. In this, students will be acquainted with the professional standards of the teaching profession to be better teachers.

Similarly, students will develop a sound understanding of teaching as mentoring and coaching. Moreover, it is necessary to identify and explore different models (reflective practice) of the development of the teaching profession. So, this course will be beneficial for everyone who can see themselves being a professional teacher with knowledge and skills of various teaching professional features.

Learning Outcomes

- Develop a sound understanding of different philosophical orientations of teaching professions in the local and global contexts
- Exhibit skills of teaching as a process of continuous growth and development of teachers through reflective practice
- Demonstrate the roles of teacher as mentor and coach
- Appraise professional standards of the teaching profession

Unit/Module Outlines

Modules/Units	Descriptions
Philosophical Foundation and Evolution of Teaching Profession	• Historical root of teaching profession • Teacher in classical and modern times • Teacher as expert, facilitator and change agent Source: https://www.sciencedirect.com/science/article/pii/S1877042816000549
Professional Standards for Teachers	• Knowing students • Knowing contents and methods • Plan and implement teaching effectively • Developing and maintaining safe learning environment • Assessing students and providing feedback for better learning • Continuing professional learning • Working professionally with communities and beyond Source:

	https://www.aitsl.edu.au/docs/default-source/national-policy-framework/australian-professional-standards-for-teachers.pdf
Models of Teacher Professional Development	• The action research model • The reflective practice/cycle model • The lifelong learning model • The currere model Source: https://www.tandfonline.com/doi/abs/10.1080/09751122.2015.11890375
Teacher in the 21st Century	• Transmitter and facilitator • Cultural reproducer and change agent • Facilitator of values clarification • Teacher as learner and researcher Source: https://journals.sagepub.com/doi/full/10.1177/1745499919829214
References	Buchanan, J. (2020). *Challenging the Deprofessionalisation of Teaching and Teachers*. Springer Singapore. Monteiro, A. R. (2015). *The teaching profession: Present and future* (pp. 47-60). Dordrecht: Springer International Publishing.

(Vocational Pedagogical Courses (20 Credit Hours = 10 Th + 10 Pr)

Courses	Credit Hours	Theory	Practical
1. VPED 100 Principles and methods of technical instruction (2)	2	1	1
2. VPED 101 Instructional System Design (2)	2	1	1
3. VPED 210 Instructional Skills (I)	2	1	1
4. VPED 220 Instructional Skills (II)	2	1	1
5. VPED 300 Designing Occupational Curriculum (2)	2	1	1
6. VPED 301 TVET Ecosystem in Nepal (2)	2	1	1
7. VPED 302 Training Methodology (2)	2	1	1
8. VPED 303 Assessment in TEVT (2)	2	1	1
9. VPED 400 Materials Development in TVET (2)	2	1	1
10. VPED 401 Enterprise Development (2)	2	1	1
Total	20	10	10

VPED = Vocational Pedagogy

The course outline of the Vocational Pedagogical Course of B Tech Ed for Semester One is overleaf and the descriptions of all Vocational Pedagogical Courses are in Annex - B

VOCATIONAL PEDAGOGICAL Courses Outline for Semester 1

Course**:** Principles and methods of technical instruction (2) Code: VPED 100

Credit Hours: 2 Nature: Theory and Practical

Course Description

This course is designed to provide theoretical and practical exposure to students in planning teaching, learning, and evaluation by applying various methods based on the subject matter. It helps develop a sound understanding to get to know the learners in terms of their background, prior learning, sociocultural contexts, etc. Similarly, the course also centralizes its goal to help students locate and acquire the resources: dry and wet labs, studios, maker space, workshop, etc. Moreover, another primary focus is to help students be aware of impending difficulties, questions, disruptive behavior, conflicts, and ways of handling them by being mindful of different learning difficulties the learners face in skills development. Also, the course focuses on promoting independent learning among the learners through self-discovery, problem-solving, and product development.

Learning Outcomes

- Demonstrate a sound understanding of various technical instructions
- Apply various methods while planning for teaching and evaluation
- Explore multiple strategies to understand students based on their background, prior learning, sociocultural contexts
- Compare and contrast among various resources
- Explore ideas to handle the behaviors of students
- Develop skills in being mindful of different learning difficulties faced by learners and help them to progress
- Apply the principles of making students independent learners
- Develop lessons that use transversal skills for their vocational areas

Module/Unit Outlines

Modules/Units	Descriptors
Introduction to Technical Instruction	• Methods and orientations, • Experiential learning of John Dewey • Developing competencies and outcomes • Developing tasks and activities Source: https://eacea.ec.europa.eu/national-policies/eurydice/content/teaching-and-learning-vocational-and-technical-upper-secondary-education_en
Understanding Students in Educational Instruction	• Developing students' profiles • Assessing prior knowledge • Planning for remedial instruction • Addressing diversities as asset Source: https://www.nap.edu/read/5287/chapter/9

Resource Materials for the Instructional Activities	• Projected and non-projected materials for technical instruction • Instructional media • Apps and Learning Management System Source: https://teaching.unl.edu/course-design/flex-hybrid/instructional-materials/
Classroom Management	• Management for efficiency and management for equity • Promoting participation • Ensuring the success for all -reaching out to all Source: https://web.calstatela.edu/faculty/jshindl/cm/Chapter11pedagogy-final.htm
Work and learning	• Situated Learning: Work as context for learning • Complexity of work and learning • Different forms of work-based learning • Developing work-based learning modules https://doi.org/10.1108/13665621311316447
Transversal Skills for technical and vocational education	• The 4 C framework—Communication, Critical Thinking, Creativity and Collaboration • The blend of soft and hard skills • Integrating transversal skills for TVET lessons Source https://bangkok.unesco.org/content/transversal-skills-tvet-pedagogies-and-assessment
References	Rus, R. C., Husain, M. A. M., Hanapi, Z., & Mamat, A. B. (2020). TVETagogy: Teaching and Facilitating Framework (PDPC) for Technical and Vocational Education and Training (TVET). *International Journal 0f Academic Research In Business And Social Sciences, 10*(3). Pavlova, M., & Chen, C. S. (2019). Facilitating the development of students' generic green skills in TVET: an ESD pedagogical model. *TVET@ Asia*, *12*, 1-21. Maclean, R., & Wilson, D. (2009). *International handbook of education for the changing world of work: Bridging academic and vocational learning* (Vol. 1). C. A. Chinien (Ed.). Dordrecht: Springer Netherlands.

OCCUPATIONAL/SPECIALISATION (80 CREDIT HOURS)

Civil Engineering (80 Credit hours = 38 Cr (TH) + 42 Cr (PR))

SN	Subjects	Credit Hours		
		Th	PR	Total
1.	CEEX 100 Construction Material	2	1	3
2.	CEEX 101 Hydrology	1	1	2
3.	CEEX 110 Fluid Mechanics & Hydraulics	2	1	3
4.	CEEX 140 Engineering Project I (Construction Drawing and model preparation)	0	2	2
5.	CEEX 200 Concrete Technology	1	2	3
6.	CEEX 201 Strength of Material	2	1	3
7.	CEEX 203 Structural Analysis	1	1	2
8.	CEEX 204 Estimation and Valuation	1	1	2
9.	CEEX 202 Water Supply and Sanitation	2	1	3
10.	CEEX 205 Geotechnical Engineering	2	1	3
11.	CEEX 210 Engineering Survey I	1	2	3
12.	CEEX 220 Engineering Survey II	1	2	3
13.	CEEX 240 Engineering Project II- Material testing	0	2	2
14.	CEEX 300 Building construction and Technology	2	1	3
15.	CEEX 301 Irrigation Engineering	2	1	3
16.	CEEX 302 Steel and Timber Structure	2	0	2
17.	CEEX 311 Hydropower Engineering	1	1	3
18.	CEEX 310 Engineering Economics and Construction Management	2	1	3
19.	CEEX 312 Reinforced Concrete Design	2	1	3
20.	CEEX 320 Transportation Engineering I	1	1	2
21.	CEEX 321 Transportations Engineering II	1	1	2
22.	CEEX 340 Engineering Project IV (Hill Road, Building Design, Hill Irrigation)	0	2	2
23.	CEEX 341 Field Survey Camp	0	2	2
24.	CEEX 348 Engineering Project III	0	2	2
25.	CEEX 400 Prestressed Concrete structures	2	1	3
26.	CEEX 431 Elective	1	1	2
27.	EGEX 100 Engineering Drawing I	1	1	2
28.	EGEX 104 Engineering Mechanics	2	1	3
29.	EGEX 110 Engineering Drawing II	1	1	2
30.	EGEX 111 Engineering Mathematics I	1	1	2
31.	EGEX 120 Engineering Mathematics II	1	1	2
32.	EGEX 140 Engineering Workshop I (Brick Laying & Plumbing)	0	2	2
33.	EGEX 141 Engineering Workshop II (Carpentry & Electrical)	0	2	2
Total		38	42	80

CEEX = Civil Engineering Education Extension Course; EGEX = Common Engineering Education Extension Course

Semester-wise Course Distribution -- B Tech Ed (Civil Engineering)

Year	Semester	Educational Core and Research (21)	Vocational Pedagogy/Research and Internship (35)	Civil	Total
1	I	EDUC 100	VPED 100	CEEX 100 EGEX 100 CEEX 110 EGEX 111 EGEX 140 (13 Credits)	18
	II	ENGT 100	VPED 101	CEEX 101 EGEX 104 EGEX 110 EGEX 120 CEEX 140 EGEX 141 (12 credits)	17
2	III	EDUC 200	VPED 210	CEEX 200 CEEX 201 CEEX 202 CEEX 210 (12 credits)	17
	IV	NEPL 200	VPED 220	CEEX 203 CEEX 204 CEEX 205 CEEX 220 CEEX 240 (12 credits)	17
3	V	EDUC 300	VPED 300 VPED 301	CEEX 300 CEEX 301 CEEX 302 CEEX 308 CEEX 310 (13 credits)	20
	VI	EDUC 301	VPED 302 VPED 303	CEEX 311 CEEX 312 CEEX 320 CEEX 321 CEEX 341 (14 Credits)	20
4	VII	EDUC 421	VPED 400 VPED 441	CEEX 400 CEEX 431	16
	VIII		VPED 401 VPED 442 VPED 499		11
					136

CIVIL ENGINEERING Courses Outline for Semester 1

Course: Engineering Drawing I Code: EGEX 100

Credit Hours: 2 Nature: Practical

Course Description

This is an introductory drawing course. The course includes ffundamental knowledge and skills such as line work, lettering, scale use, sketching, multi-view drawings, sectional views, and the basics of manual drafting techniques and drafting equipment.

Objectives/Learning Outcomes

- Illustrate the use of dimensions and engineering scale
- Get acquainted with the terminologies used in Engineering drawing
- Draw primary engineering curves such as ellipse, parabola, hyperbola and spirals
- Demonstrate the orthographic projection skills

Unit/Module 1

Introduction of Engineering Drawing and Instruments Used in Engineering Drawing: E.g., Drafter,

types of Pencil, set squares, etc. The layout of Drawing Sheets, Types of Lines, Lettering

Layout and lettering Practice.

Dimensioning

Unit of Dimensions, System of Dimensioning, Shape identification Dimensioning

Engineering Scale

Representative Factor, Construction and Types of Scales, Plain Scales, Diagonal Scales, Vernier Scales, Comparative Scales, Scale of Chords

Geometrical Constructions:

To divide the lines into any number of equal parts, to divide a given angle into even number of divisions. To draw an arc tangential to a line and passing through a point., Construction of regular polygons.

UNIT/MODULE 2

Introduction of Engineering Curves

The terminology used in Engineering Curves and a brief discussion about types and applications of Engineering Curves.Definition and Terminology of Conic Section, Applications, Construction of Conic Sections,

Ellipse: Definition and Terminology, Applications, finding out foci when Major and Minor axis are given, Drawing Tangents to Ellipse at a point on the ellipse or from a point outside the ellipse.

Different Methods of Construction of Ellipse:

- Pin and Thread Method
- Intersecting Method
- Rectangle Method
- Circle Method
- Trammel Method
- Concentric circle Method
- Parallelogram Method
- Four centers approximate Method

Parabola: Definition, Terminology and Applications, to find the axis, focus and directrix of a Parabola. Drawing Tangents to the Parabola either at a point on the Parabola or from a point outside the Parabola

i. When the focus and directrix are given
ii. When the focus and directrix are not given

Different methods of construction of Parabola

i. Rectangle Method
ii. Parallelogram Method
iii. Tangent Method

Hyperbola: Definition, Terminology and Applications, Drawing Tangents to the Hyperbola either at a point on the Hyperbola or from the point outside the Hyperbola, Different Methods of construction of Hyperbola, Definition and construction of Rectangular Hyperbola, Involutes: Definition and Terminology, Applications, Drawing Tangent and Normal at a point on Involutes, Definition and Construction of Involutes by

- Involute of a line
- Involute of a Triangle
- Involute of a Polygon

Spirals: Definition and Terminology, Applications, Definition and Construction of Archemedian and Logarithmic Spirals, Drawing Tangent and Normal at a point on Spirals

Cycloidal Curves:

Definition and Terminology, Applications, Definition and Construction of Epicycloid and Hypocycloid

Drawing Tangent and Normal at a point on Cycloidal Curves, Definition, Terminology and Applications of Trochoid, Epitroichoid, and Helix

UNIT/ MODULE 2: Orthographic Projections

Projection of an Object, Principal Views and Principal Planes of Projection, Four Quadrants and System of Projection, First angle and Third angle Projection, Difference between them and their advantages, Symbols of Projection, Projection of Points, Projection of Lines, Definition, True length and True Inclination of a Line

Line Parallel to both the Planes, Line Parallel to one Plane and Perpendicular to Other plane, Line Parallel to one Plane and Inclined to Other, Line Inclined to both Horizontal and Vertical plane, Convention for Line Thickness

Projection of Plane Surfaces: Definition, True shape of a plane surface, Plane surface parallel to one of the Principal Planes and Perpendicular the other two, Plane Surfaces Perpendicular to one of the three Principle Planes and Inclined to other two, Plane Surfaces Inclined to all the three Principal Planes of Projection

Projection of Solids: Definition of Solids, Classification of Solids e.g. Polyhedrons, Prisms, Pyramids), Projection of Solids Placed in different positions, Axis of the Solid Perpendicular to HP,

Axis of the Solid Perpendicular to VP, Axis of the Solid Perpendicular to HP and Parallel to VP, Axis of the Solid Inclined to VP and Parallel to HP,Axis of the Solid Inclined to both HP and VP, Methods of Solving the Problems of Cubes, Cones, Prisms, Cylinders, Pyramids Surface Development: Methods of Development, Parallel Line Development, Radial Line Development, Triangulation Development, Approximate Development

CIVIL ENGINEERING Courses Outline for Semester 1

Course: Construction Material | Code: CEEX 100

Credit Hours: 3 | Nature: Theory and Practical

Course description:

This course focuses on the basic construction materials used in different construction works.

Course objectives:

- Recognize various construction materials that are essential in construction;
- Select the quality materials for use in construction;
- Test materials for quality, strength, and durability and
- Use available materials in their proper position and state.

Units/Modules

Unit/Module 1:Structure and properties of materials
Fundamentals of material structure, from atomic bonding to failure theories; structure-property relationships; general engineering properties of materials

Unit/Module 2: Stone / Brick / Mortar
Properties and application of masonry materials; types of bonding; deterioration processes

Unit/Module 3: Cement and Concrete
Cement composition and properties; properties of other ingredients; basic concrete mixture proportioning; Early age and long term properties; construction methods with concrete

Unit/Module 4:Steel / Aluminium / Copper
Structure of iron and steel – phase diagrams; properties of reinforcing steel and structural steel; corrosion; properties and applications of Al and Cu

Unit/Module 5:Composite materials / FRP / Polymers and Plastics, Particulate and fiber-reinforced composites; structure and behaviour of polymers and plastics

Unit/Module 6: Wood / Glass
Structure of wood; processing of timber for construction; defects and deterioration of wood; properties and applications of glass

Unit/Module 7:Pavement materials
Basic pavement materials such as WBM and WMM; structure and properties of asphalt; proportioning and application of bituminous concrete for flexible pavements; understanding of rigid pavements – jointed, doweled and continuously reinforced

CIVIL ENGINEERING Courses Outline for Semester 1

Course**:** Engineering Workshop I (Brick Laying & Plumbing) Code: EGEX 140

Credit Hours: 3 Nature: Practical

Course Description

This course focuses on hands-on familiarization activities of bricklaying and plumbing and their standard requirements for construction. The course also deals with pointing and curing works.

Objectives/Learning Outcomes

- Understand the concept of bricklaying;
- Identify major operations related to civil engineering works;
- Identify and select the tools and equipment required for bricklaying and
- Perform different bricklaying works on different bonding patterns.
- Apply operating systems of plumbing works;
- Identify the tools and equipment required for plumbing works;
- Perform simple pipe fittings works and
- Prepare the PVC fittings.

Course Outline

Unit/Module One: Orientation to bricklaying

- Introduction of Bricklaying,
- Observation of Safety Precaution,
- Identifying Bricklaying Materials,
- Proper use of Hand Tools,
- Proper use of Bricklaying Equipment/Machines,
- Constructing Walls using Bricks in lime mortar English Bond,
- Constructing Walls in Various types of Bond,
- Demonstrating various Types of Bond,
- Demonstrating various Types of Pointing, Curing Walls,
- Building Foundation Footing Courses Wall (Square footing):

Unit/Module Two: Bricklaying projects

- Identify/enumerate/ handle tools/equipments/materials related to bricklaying.
- Prepare workshop floor areas, Set out work area,Position materials/tools and Prepare the mortar
- Handle motor, pick up the motor, handle brick trowel properly positioning yourself, layout line, spread motor, furrow mortar, pick up bricks and lay bricks to line, and watch bond.
- Lay stretcher bond wall making 4 bricks long and 6 courses high using gangue rod properly.
- Build English bond wall 1 brick thick (9") up to 7 courses high to gauge and pointing to appropriate dimensions.

- Build Flemish bond wall up to 6 courses high to gauge and pointing to appropriate dimensions.
- Build 1.5 brick thick (14") wall to English bond return corner of English bond. One end ranked back and other end completely stopped as per given dimensions, up to five courses high.
- Build a T-junction wall of English Bond pattern as per given dimensions up to 6 courses high.
- Construct a 3" thick cavity wall using butterfly wall ties providing cavity clean using cavity clean batten or board, dry bond only.
- Construct a rattrap bond wall making 9" thick (1 brick thick wall) up to 6 courses high showing internal trap clear, dry bond only.

Unit/Module 3: Orientation to Plumbing

- Introduction of Plumbing
- Plumber's Hand Tools
- Galvanized Pipe Fittings/PVC fittings:
- Pipe Threading to Dimension:
- Assembling the Threaded Pipe to Fittings with Pipe Tape as per Drawing
- Making up H.D.P fittings:
- Introduction of Welding
- Bar Bending Works:
- Fixing or Fastening Rods to Wire:

Unit/Module Four: Plumbing projects

- Identify/enumerate/use hand tools and equipments
- Demonstrate pipes, plates to shape and size.
- File to clean pipe end (mouth).
- Cut/thread G.I pipe to given dimensions.
- Make nipples to appropriate standard.
- Make and assemble using various pipes as Elbow, Union and tee in a Rectangular Loop.
- Cut /join H.D.P. pipe and PVC pipe
- Make L, cross and T bends project of PVC pipe
- Join PVC fittings with PVC pipe.
- Install PPR pipe with fittings.
- Install CPVC pipe with fittings.
- Perform internal (below ground level) pipe layout and assembling fittings using pipe tape for
- water supply or sanitation works
- Perform external (wall) pipe layout and joining fittings for water supply.
- Tie reinforcement of 12 mm o rods of tor steel @ 6"c/c spacing for a basement RCC footing slab of 1 mx1m size showing 15cm (L) at its ends, and tie the rods in a double knot method.
- Weld two plates of 10 mm thick together making butt joint, do filing on it.

CIVIL ENGINEERING Courses Outline for Semester 1

Course**:** Engineering Mathematics I Code: EGEX 111

Credit Hours: 3 Nature: Practical

Course Description

To provide enough mathematical facts to cope with a wide variety of engineering problems. The course is not overloaded with scrupulous proof, which has little practical application. The course demands explaining the fundamental ideas and showing how they are applied in other disciplines mentioned above.

Course Objectives/Learning Outcomes

1. Illustrate the use of differential calculus in a variety of contexts such as finding the rate of change, continuity, maximum and minimum values
2. Demonstrate the application of integral calculus in finding the area, volume, length of the path, etc.
3. Exhibit the use of convergent and divergent series in **the directional relationship of two trends, prices, or indicators**
4. Apply determinants and matrix to solve the system of linear equations

Unit/Module 1 Differential Calculus

Increments: Average and instantaneous rates of change, The slope of a curve y = f(x) Derivatives as the instantaneous rate of change, Velocity and other rates of change.

Limits and continuity: Properties of limits, One sided limits, existence of limit at a given point, Infinity as a limit, Limits of exponential and logarithmic functions, Types of discontinuity.

Differentiation: Formal definition, Polynomial functions and their derivatives, Product, Power and quotient rules, Implicit differentiation and fractional power, The chain rule and parametric equations, Angle between two curves, Derivatives of trigonometric functions, Differentials

Applications of derivatives: Curve sketching, The sign of first derivatives, Concavity and points of inflection, Asymptotes and symmetry, Maxima and minima; Theory and problems

Related rates, Roll's Theorem and Mean value theorem, Indeterminate forms L-Hospital's rule, Extending the Mean value theorem to Taylors formula

Unit/Module 2 Integral Calculus

Integration: Introduction, Indefinite integration, Applications of determining constants of integration, Integrals of trigonometric functions, Definite integrals; The area under a curve

Calculating areas as limits,the fundamental theorem of integral calculus, Integration by substitution, Differentials.

Integration methods: Basic integration formulas, Integration by parts, Product and powers of trigonometric functions

Integration methods: Basic integration formulas, Integration by parts, Product and powers of trigonometric functions, Even powers of sines and cosine trigonometric substitutions in integrals involving a2+u2 and integrals involving ax^2+bx+c
Partial fractions ,The substitution; z = tan(x/2), Improper integrals.

Application of Definite integrals: Area between two curves, Distance Calculating volumes by slicing, Length of a plain curve, Area of a surface of revolution, Average value of a function

Module/Unit 3 Sequence and Series

Sequence and infinite Series: Sequence of numbers, Limits that arise frequently, Infinite series, Test for convergence of series with non-negative terms, Absolute convergence, Alternating series, Conditional convergence.

Module/Unit 4 System of Linear Equations, Matrix and Determinants

Systems of linear equations: Row operation method and Gaussian elimination, reduced echelon form, Consistency and row rank, Matrix representation of linear system, Solutions of linear systems

Matrix and Determinants: Matrix operations, Special types of matrices, The inverse of a matrix, Properties of determinants, Rank of a matrix, Applications of matrices and determinants

References:

1. Thomas & Finney, Calculus and Analytical Geometry, Sixth edition Narosa Publishing House New Delhi
2. J.W.Brown & D.R. Sherbert, Introductory Linear Algebra
3. D.T.Finkbeiner,Introduction to Matrices and Linear Transformations 3rd edition CBS publisher anddistributors, Delhi.

CIVIL ENGINEERING Courses Outline for Semester 1

Course**:** Fluid Mechanics & Hydraulics Code: CEEX 110

Credit Hours: 3 Nature: Theory and Practical

Course description:

This course focuses on Hydraulics's fundamental concepts and principles, measurement of flow, introduction to open channel flow, and pipe flow.

Course objectives:

- Understand the properties of fluid;
- Analyze the behaviour of fluid at rest;
- Analyze the behaviour of fluid in motion;
- Apply the measurement techniques for pressure and discharge;
- Understand the concept of head loss in pipe flow and
- Understand the basic concept of open channel flow.

Course Outlines

Unit/Module One Introduction

- Introduction to Fluid
- Introduction to Fluid Mechanics and Hydraulics
- Properties of fluid (Definition, formula, unit and dimension): mass density, specific weight, specific volume, specific gravity, viscosity (Newton's law,
- Dynamic and kinematic viscosity), compressibility and Bulk Modulus
- Difference between real and ideal fluid
- Difference between Newtonian and Non-Newtonian fluid

Unit/Module Two: Hydrostatics

- Introduction to fluid pressure
- Pascal's law
- Derivation for pressure-depth relationship (Hydrostatic law)
- Definition of atmospheric pressure, gauge pressure and absolute pressure
- Measurement of pressure by piezometer and U-tube manometer
- Definition of total pressure and centre of pressure
- Derivation for total pressure and centre of pressure on vertical and inclined plane submerged surface
- Definition of Buoyancy and Archimedes' principle
- Principle of floatation

Unit/Module Three: Hydrokinematics

- Types of flow: Steady and unsteady, uniform and non-uniform, laminar and
- turbulent, compressible and incompressible, rotational and irrotational, one, two and three dimensional
- Reynold's number: Definition, equation and criteria for laminar and turbulent flow
- Streamline: Definition, equation, characteristics
- Conservation principles and continuity equation for one dimensional incompressible flow

Unit/Module Four: Hydrodynamics

- Energy of flowing fluid: potential or datum energy, kinetic energy, pressure energy
- Concept of energy head
- Bernoulli's theorem: Statements, assumptions, equation and applicability
- Concept of Hydraulic gradient line (HGL) and energy gradient line (EGL)

Unit/Module Five: Pipe Flow

- Introduction to pipe flow
- Velocity profile for laminar and turbulent flow through pipes
- Loss of head in pipes: introduction to major and minor loss
- Derivation of Darcy-Welsbach equation for loss of head due to friction
- Derivation of equation for expansion and contraction loss

Unit/Module Six: Open Channel Flow

- Difference between pipe flow and open channel flow
- Types of open channel flow: steady and unsteady, uniform and non-uniform (gradually varied, rapidly varied and spatially varied flow), laminar and turbulent, subcritical, critical and supercritical flow
- Geometric elements of open channel (flow depth, flow area, top width, wetted perimeter, hydraulic radius, hydraulic depth, section factor)
- Velocity distribution in open channel flow
- Chezy's equation and Manning's equation for the computation of velocity in uniform flow
- Energy equation and momentum equation in open channel flow
- Specific energy: Definition, equation and diagram

Unit/Module Seven: Flow Measurement

- Orifice: Definition and types, definition of vena-contract
- Derivation of equation for discharge through small orifice
- Hydraulic coefficients of orifice: coefficient of discharge, velocity and contraction (definition, formula and experimental method of determination)
- Concept of venturimeter, derivation of equation for discharge through venturimeter
- Introduction to weir or notch and their classifications
- Derivation of equation for discharge through rectangular, triangular and trapezoidal weir or notch
- Area-velocity method for the discharge measurement in open channel (float and current meter): description of measurement technique, mid-section method for discharge computation

Unit/Module Eight: Hydraulic Structure

- Introduction to Hydraulic Structure
- Analysis of Forces acting on Hydraulic Structures
  Dams,
  Arch Dam
  Button Dam
  Earthen and
  Rockfill dams
- Seepage through the Hydraulic Structures,

Project-based activities

- Hydro static forces on submerged body
- Measure pressure by piezometer and manometer
- Verify Bernoulli's theorem using venturimeter
- Measure flow through orifice
- Head loss in pipe
- Flow through open sluice gate
- Hump and constricted flow analysis
- Hydraulic jump analysis

Textbooks:

a. R.K. Bansal, *"Fluid Mechanics and Hydraulic Machines"*, Laxmi Publications (P) Ltd.
b. R.K. Rajput, *"Fluid Mechanics and Hydraulic Machines"*, S. Chand & Company Ltd.
c. A.K. Upadhyay, *"Hydraulics and Pneumatics"*, S.K. Kataria and Sons.

Internship and Research (18 Credit Hours = 1 Th + 17 Pr)

SN	Courses	Theory	Practical	Total
1	EDUC 421 Educational Research	1	2	3
2	VPED 441 Internship – Teaching/Training	0	6	6
3	VPED 442 Internship – Work-based learning	0	6	6
4	VPED 499 Educational Research Project	0	3	3
	Total	1	17	18

Evaluation Scheme

The evaluation scheme shall follow a continuous assessment system with an ethos of competency-based assessment. Specifically, the practical components shall be assessed in the lab, at the workplace, and/or via a learning portfolio. The theoretical components shall be evaluated via written, oral, demonstration and/or all means. Kathmandu University Grading System will apply.

Graduation Requirements

Individuals completing all of the requirements shown on their approved Planned Program of Study are eligible for graduation. However, the required minimum cumulative grade point average (CGPA) of courses is 2.00 and also in the examination administered by Kathmandu University (See details in "Grading and Certification System").