Bachelor of Technical Education (B Tech Ed)

(Mechanical Engineering-Automobile)

Kathmandu University

School of Education

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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 (BTechEd) 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.

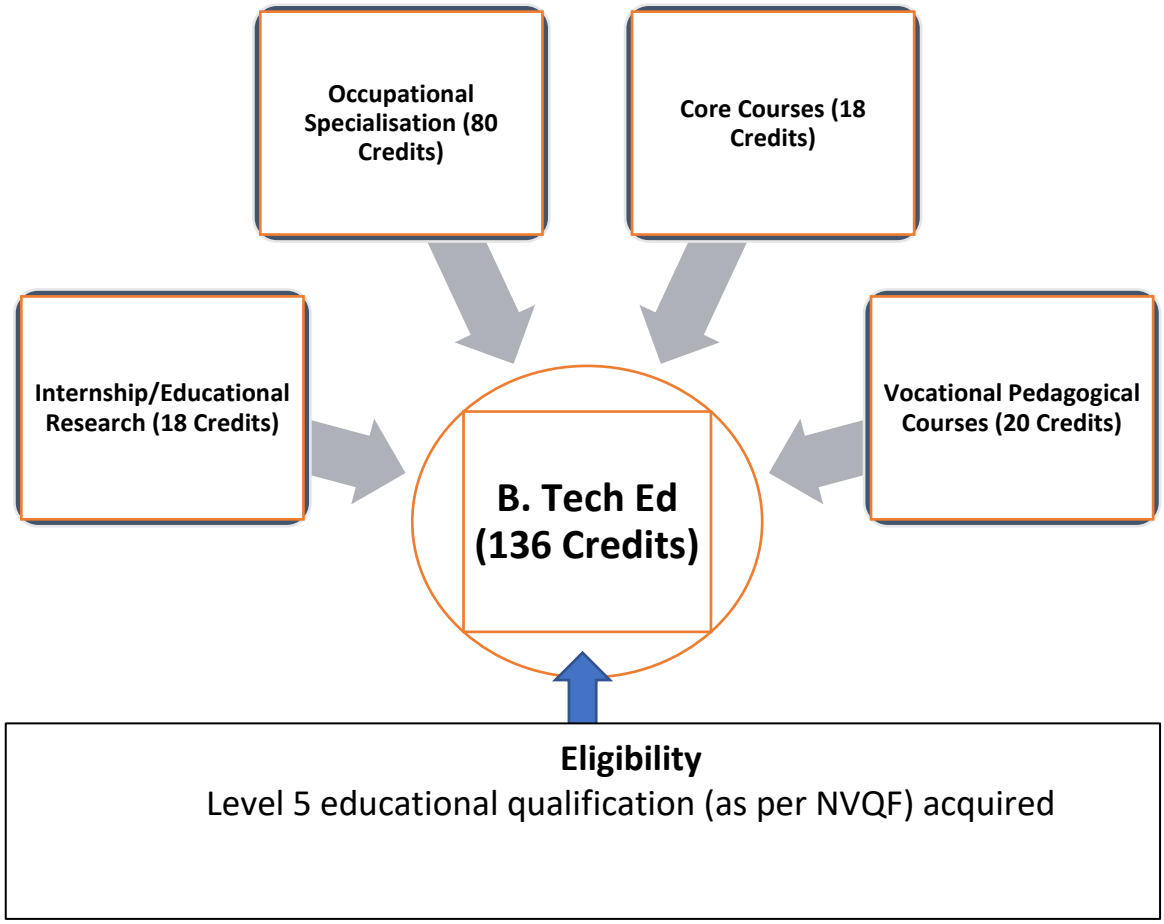
The following are the aims of the program:

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



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

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

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)

Mechanical Engineering – Automobile (80 Credit Hours = 32 Th + 48 PR)

SN	Courses	TH	PR	Total
1.	AEEX 100 Basic Automobile Engineering (3)	2	1	3
2.	AEEX 110 Computer-Aided Automobile Design I (3)	1	1	2
3.	AEEX 200 Automobile Electronics (3)	2	1	3
4.	AEEX 220 Computer-Aided Automobile Design II	1	2	3
5.	AEEX 300 Automobile Technology	1	2	3
6.	AEEX 301 Power Unit and Transmission	1	2	3
7.	AEEX 310 Dent and Paint Techniques	1	2	3
8.	AEEX 311 Alternative Fuel Energy System	1	2	3
9.	AEEX 340 Project I	0	3	3
10.	AEEX 330 Elective	1	1	2
11.	AEEX 499 Project II	0	3	3
12.	CEEX 201 Strength of Materials	1	2	3
13.	EGEX 123 Engineering Mathematics II (2)	1	1	2
14.	EGEX 100 Engineering Drawing I (2)	1	1	2
15.	EGEX 110 Engineering Drawing II (2)	1	1	2
16.	EGEX 111 Engineering Mathematics I (2)	1	1	2
17.	EGEX 200 Engineering Mechanics	2	1	3
18.	ELEX 100 Basic Electrical Engineering (3)	2	1	3
19.	ITEX 102 Computer Programming using C (3)	2	1	3
20.	MEEX 100 Basic Mechanical Engineering (3)	2	1	3
21.	MEEX 110 Basic Manufacturing Process (3)	2	1	3
22.	MEEX 200 Theory of Machine	1	2	3

23.	MEEX 206 Engineering Thermodynamics	2	1	3
24.	MEEX 211 Machine Design I	1	2	3
25.	MEEX 212 Fluid Mechanics	1	2	3
26.	MEEX 220 Advanced Manufacturing Process	1	2	3
27.	MEEX 241 Mechanical Workshop (lab)	0	2	2
28.	MEEX 312 Heat Transfer	1	2	3
29.	MEEX 320 Machine Design II	1	2	3
30.	Total	34	46	80

AEEX = Automobile Engineering Education Extension Course

ITEX = Information Technology Education Extension Course

Semester-wise Course Distribution -- B Tech Ed (Mechanical Engineering-Automobile)

Year	Semester	Educational Core and Research (21)	Vocational Pedagogy/Research and Internship (20)	Mechanical-Automobile	Total
1	I	EDUC 100 (3)	VPED 100 (2)	EGEX 100 MEEX 100 ELEX 100 ITEX 102 EGEX 111	18
	II	ENGT 100	VPED 101	AEEX 100 EGEX 110 MEEX 110 AEEX 110 EGEX 123	17
2	III	EDUC 200	VPED 210	AEEX 200 MEEX 200 EGEX 200 MEEX 211 AEEX 220	19
	IV	NEPL 200	VPED 220	CEEX 201 MEEX 206 MEEX 211 MEEX 220 MEEX 212	20
3	V	EDUC 300	VPED 300 VPED 301	AEEX 300 MEEX 312 MEEX 320 AEEX 340	19
	VI	EDUC 301	VPED 302 VPED 303	AEEX 301 AEEX 310 AEEX 311 AEEX 330	18
4	VII	EDUC 421	VPED 400 VPED 441	AEEX 499	14
	VIII		VPED 401 VPED 442 VPED 499		11
					136

MECHANICAL ENGINEERING - AUTOMOBILE 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 fundamental 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 3: 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

MECHANICAL ENGINEERING - AUTOMOBILE Courses Outline for Semester 1

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

Credit Hours: 2 Nature: Theory and 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 different other disciplines mentioned above.

Course Objectives/Learning Outcomes

- Illustrate the use of differential calculus in a variety of contexts such as finding the rate of change, continuity, maximum and minimum values
- Demonstrate the application of integral calculus in finding the area, volume, length of the path, etc.
- Exhibit the use of convergent and divergent series in **the directional relationship of two trends, prices, or indicators**
- 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.

MECHANICAL ENGINEERING - AUTOMOBILE Courses Outline for Semester 1

Course**:** Basic Mechanical Engineering Code: MEEX 100

Credit Hours: 3 Nature: Theory and Practical

Course description:

The course introduces students to basic mechanical engineering about statics, dynamics, thermodynamics, fluid mechanics, and heat transfer.

Objectives/Learning Outcomes

- Develop acquaintance with basic concepts of mechanical engineering such as statics, dynamics, fluid mechanics, etc.
- Apply these different concepts in real-world contexts, such as designing the machine, performing the artisan works, and other machine-use related situations
- Demonstrate the use of fundamental mechanical engineering concepts by showing examples of locally available machines and/or machine-like objects

Course Outlines

Unit/Module 1: Engineering Statics: equivalent force systems: equilibrium, friction, cables, centre of gravity

Unit/Module 2: Engineering Dynamics: Velocity, acceleration, momentum, Newton's second law of motion, the moment law, work and energy, rotation about a fixed axis

Unit/Module 3: Strength of Materials: concepts of stress, strain, stress-strain diagram, Hook's law

Unit/Module 4: Thermodynamics: properties of substances, the first law of thermodynamics, entropy and second law of thermodynamics, Thermodynamic cycles, gas compression, refrigeration, gas and steam turbines

Unit/Module 5: Fluid Mechanics: introductory concepts, fluid in motion, continuity equation, mass conservation, viscosity, Bernoulli's equation, boundary layer, laminar and turbulent flow, turbomachines, momentum, impulse turbine, axial flow and centrifugal, machines, hydraulic turbines.

Unit/Module 6: Heat Transfer: steady-state and transition heat conduction, one-dimensional and two-dimensional heat flow, heat transfer by radiation, convective heat transfer, free and forced convection.

References:

1. F Krieth: Principles of Heat Transfer Harper & Row
2. I H Shames: Engineering Mechanics Statics and Dynamics (SI Version),PHI
3. J R Howell & R U Buckins: Fundamental of Engineering Thermodynamics, McGH.
4. E P Popov : Mechanics of Materials (SI Version) PHI
5. D S Kumar: Fluid Mechanics and Fluid Power Engineering, Katsen Publishing House

MECHANICAL ENGINEERING--AUTOMOBILE Courses Outline

for Semester 1

Course**:** Basic Electrical Engineering Code: ELEX 100

Credit Hours: 3 Nature: Theory and Practical

Course Description

The course provides a foundation in electrical engineering applicable to mechanical engineering students,to Impart a basic knowledge of electrical quantities such as current, voltage, power, energy, and frequency to understand the impact of technology in a global and local context.

Objectives/Learning Outcomes

- Develop working knowledge to analyze basic DC and AC circuits used in electrical and electronic devices.
- Explain working principle, construction, applications of DC machines, AC machines & measuring instruments.
- Highlight the importance of transformers in transmission and distribution of electric power.
- Appy the basic electrical engineering knowledge in the context of machical engineering and other contexts

Course Outlines

Unit/Module One: Basic Circuit Theory: Ideal, Non-ideal, Dependent and Independent sources **Resistors:** characteristics (Value, power rating codes, tolerances), current, voltage, power relationship, equivalent resistance in parallel and series connection, temperature coefficient, delta-star connection, Kirchhoffs current and voltage laws, voltage divider and current divider formula, Node and Mesh analysis, solution by determinant and substitution, Superposition theorem. Thevenins and Nortons Theorem and network solution using these theorems, Maximum power transfer to the load in a 2 -port resistive network.

Unit/Module Two: AC Circuit Fundamentals: Generation of AC voltage (brief theoretical introduction of ac machine), Definition of time period, frequency, waveform, phase, phase difference Peak, peak-to-peak, average, RMS or effective value of any type of ac voltage or current waveform

Unit/Module Two: Phasors: phasor algebra, steady state analysis of RLC circuits, Impedance, Admittance, Reactance, Real, reactive and apparent power, power factor. Significance of p. factor, Resonance in series and parallel RLC circuits, Bandwidth, Effect of Q-factor in resonance.

Unit/Module Three: 3-Phase Circuits: Generation of 3-phase, merits of 3-phase over 1-phase generation, Phase sequence (ABC or CBA), Voltage and current phasor in different sequence (i.e.

ABC or CBA) Line and phase quantities in Y-connected or Delta connected balanced load, Y-delta equivalence, Power in 3-phase circuits

Unit/Module Four: Magnetic Circuits and Transformers: Revision of electromagnetism. Magnetic field and flux, Magnetic field strength, MMF, permeability of free space. Relative permeability, Introduction to a simple magnetic circuit with air gap, reluctance, permeance, and comparison of magnetic circuit with electric circuit. Faradays law of electromagnetic induction, self inductance and mutual inductance, coupling coefficient, dot convention in electric circuit.

Unit/Module Five: Single Phase Transformers: Construction, principle of operation, ideal transformers, and voltage and current relationship, turn ratio. Operation of relay and solenoid.

Unit/Module Six: Dc-Machines: construction, operation, EMF and torque relations, Series and shunt motor characteristics and performance starting and speed control

Module Seven: Synchronous Machines: construction, operation, rotating field and characteristics of synchronous machines, mains synchronisation

Unit/Module Eight: Induction Motor: construction and operating principles, basic relations, performance, single phase induction motor
Principle Of The Dc Voltmeter, Ammeter, And Ohmmeter: Voltmeter sensitivity and error correction.

References:

- R J Smith Circuits Devices and Systems, Wiley Int. Edition, 5th Ed., 1991
- E Hughes Electrical Technology ELBS, 6th ED., 1987
- R Del Toro Principles of Electrical Engineering PHI, New Delhi, 1987
- J Nagrath Basic Electrical Engineering Tata McGraw Hill, Delhi

MECHANICAL ENGINEERING - AUTOMOBILE Courses Outline for

Semester 1

Course: Computer Programming with C Code: ITEX 102
Credit Hours: 2 Nature: Theory and Practical

Course Description

This course introduces the fundamental concepts of procedural programming in C. Topics include data types, control structures, functions, arrays, etc. This course also focuses on the development of problem-solving skills using programs.

Objectives/Learning Outcomes

- Demonstrate a sound comprehension of the fundamental concepts and methodologies of computer programming
- Identify different data types and use them in a simple data processing application
- Code, compile, and test C programs
- Demonstrate the use of an array, functions, pointers, and file handling in C

Course Outlines

Module/Unit One: Introduction/Foundation

Introduction to Computer Systems

- Brief history of computation
- Architecture and Peripherals

Introduction to Software Systems

- System Software
- Application Software
- Programming Languages

Introduction to Software Life Cycle

- Problem solving and software engineering a brief introduction (SDLC)
- Algorithms and Flowchart

Fundamentals of C

- The C Character Set
- Identifiers and Keywords
- Data Types
- Variables, Constants, Declarations Statements

Unit/Module Two: Processes and Operations

Operators and Expressions

- Introduction
- Arithmetic Operators
- Unary Operators
- Relational and Logical Operators
- Assignment Operators
- Conditional Operators
- Operator Precedence

Unit/Module 3: Decisions and Control System

Decision Control Statements

- Introduction
- The if-else Construct
- The nested if-else Construct
- The else-if ladder Construct
- The switch Construct

Loop Control Statements

- Introduction
- The while Construct
- The do-while Construct
- The for Construct

Unit/Module 4: Functions and Structure

Functions [3 hours]

- Anatomy of a Function (Defining a function, accessing a function)
- Function Prototype
- Recursion (Introduction and some programs)

Program Structure

- Storage Classes
- Automatic, External and Static Variables

Arrays

- Introduction
- Processing an Array
- Passing Arrays to Functions
- Multidimensional Array

Structures

- Understanding Cs Structures
- Referencing a Structure Member
- Using Structure with Function calls
- Arrays of Structures
- Understanding Unions

Pointers

- Introduction
- Passing Pointers to Functions
- Pointers and One Dimensional Array
- Pointers to Structures
- Dynamic Memory Allocation

- Operations on Pointers

Reference

Byron s. Gottfried, Theory and Problems of Programming with C, 2/e, McGraw-Hill.

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").