Detailed Program

Bachelor of Technology (B.Tech)

(Mechanical Engineering)

Semester-VII

(2016-20)

DOC201906170033

RNB GLOBAL UNIVERSITY

Educating stars for tomorrow

RNB GLOBAL UNIVERSITY

RNB Global City, Ganganagar Road,

Bikaner, Rajasthan 334601

OVERVIEW

RNB Global University follows Semester System. Accordingly, each academic year is divided into two semesters, **Odd (July-December) and Even (January-June).** Besides this, the university follows a system of continuous evaluation along with regular updating in course curricula and teaching pedagogy.

The curriculum for B.Tech. Program for (July-December) Odd Semester, 2019 along with examination pattern is as follows:

Course Scheme

Semester –VII

S. No.	Course Code	Course Title	L	T	P	Credits
1.	19011300	Mechatronics	3	1	0	4
2.	19011400	Mechanical Vibration	3	0	0	3
3.	19011500	Mechanical Vibration Lab	0	0	2	1
4.	19011600	Product Design and Development	3	0	0	3
5.	19011700	Turbo Machines	3	0	0	3
6.	19011800	Numerical Methods	3	0	0	3
7.	19011900	Numerical Methods Lab	0	0	2	1
8.	19012000	Summer Internship & Report -II	0	0	12	6
9.	19010400	Capstone Project	0	0	12	6
10.	19012100	Professional Development	2	0	0	2
11.	99002700	Human Values & Social Service/NCC/NSS	-	-	-	1
12.	99002800	Workshops & Seminars	-	-	-	1
		Total	**17**	**1**	**28**	**34**

EVALUATION SCHEME- THEORY

The evaluation of the theory paper of B.Tech would be based on Internal and External Assessments. Internal Assessment would consist of 50% of the marks (50 marks) and external assessment (in form of End Term Exam) would consist of remaining 50% marks (50 marks). Detailed scheme of Internal and External Assessments as follows:

Internal Assessment

The distribution of Internal Assessment Marks is as follows:

Type	Details	Marks
Mid Term	Two Mid-term Sessional of 15 marks each (15+15)	30
Marks obtained in various Tests, Assignments, Presentations, Quiz, Tutorials, etc.	Average of marks obtained	15
Attendance	75%+ : 5 marks	5
TOTAL	**50**	

External Assessment

Type	Marks
Theory	50

EVALUATION SCHEME -PRACTICAL

The evaluation of the practical paper of B.Tech would be based on Internal and External Assessments. Internal Assessment would consist of 50% of the marks (50 marks) and external assessment (in form of End Term Exam) would consist of remaining 50% marks (50 marks). Detailed scheme of Internal and External Assessment is as follows:

Internal Assessment

Type	Details	Marks
Marks obtained in various manuals, practical file, participation, any model prepared, output of practical	Average of marks obtained	45
Attendance	75%+ : 5 marks	5
TOTAL	**50**	

External Assessment

Type	Marks
Practical	50

CURRICULUM

Course Name: Mechatronics

Course Code: 19011300

Course Outline

Unit I: Introduction
Introduction, scope and applications of Mechatronics systems. Process control automation, FMS and CNC Machines.
MEMS: Basics of Micro- and Nanotechnology, microprocessor-based controllers and Microelectronics.

Unit II: Introduction to Sensors
Linear and Rotational Sensors, Acceleration, Force, Torque, Power, Flow and Temperature Sensors, Light Detection, Image, and Vision Systems, Integrated Micro-sensors,
Introduction to Actuators: Electro-mechanical Actuators, Electrical Machines, Piezoelectric Actuators, Hydraulic and Pneumatic Actuation Systems, MEMS: Micro-transducers Analysis, Design and Fabrication.

Unit III: Systems and Controls
The Role of Controls in Mechatronics, Role of Modelling in Mechatronics Design, Signals and Systems: Continuous and Discrete-time Signals, Z-Transforms and Digital Systems, Continuous- and Discrete-time State-space Models.
Advanced Control Systems: Digital Signal Processing for Mechatronics Applications, Control System Design, Adaptive and Nonlinear Control Design, Neural Networks and Fuzzy Systems, Design Optimization of Mechatronics Systems.

Unit IV: Data Acquisition and related Instrumentation
Introduction to Data Acquisition Measurement Techniques: Sensors and Transducers, Quantizing theory, Analog to Digital Conversion, Digital to Analog (D/A) conversation, Signal Conditioning.
Real time Instrumentation: Computer-Based Instrumentation Systems, Software Design and Development, Data Recording and Logging.

Unit V: Design of Mechatronics systems
Introduction of mechatronics systems: Home appliances, ABS (anti-lock braking system) and other areas in automotive engineering, Elevators and escalators, Mobile robots and manipulator arms, Sorting and packaging systems in production lines, Computer Numerically Control (CNC) production machines, Aero-planes and helicopters, Tank fluid level and temperature control systems.

Suggested Readings

1. Bolton, W., "Mechatronics: Electronic Control Systems in Mechanical and 2011 Electrical Engineering.
2. Mechatronics HMT Hand Book, Tata McGraw Hill.
3. Alciatore and Histand, "Introduction to Mechatronics and Measurement Systems", Tata McGraw Hill.
4. Smaili and Mrad, "Mechatronics: Integrated Technologies for Intelligent Machines" Oxford.
5. Mahalik N.P., "Mechatronics: Principles, Concepts and applications", Tata McGraw Hill.

Course Name: Mechanical Vibration

Course Code: 19011400

Course Outline

Unit I: Introduction
Basic concepts, Types of vibration, Periodic & Harmonic vibrations, Methods of vibration analysis

Unit II: Vibration of Single Degree of Freedom System
Undamped free vibrations, damped free vibrations and damped force vibration system, modelling of stiffness and damping (both viscous and coulomb), estimation of damping by decay plots, vibration isolation transmissibility, vibration measuring instruments.

Unit III: Two degrees of Freedom systems

a) Principal modes of vibrations, natural frequencies, amplitude ratio, undamped free, damped free, forced harmonic vibration, semi-definite systems, combined rectilinear & angular modes; Lagrange's equation.
b) Application to un-damped and damped absorbers: Vibration absorber – principle; centrifugal pendulum vibration absorber, torsional vibration damper, untuned dry friction and viscous vibration damper, torsional vibration absorber.

Unit IV : Multi-degree of freedom systems
Undamped free vibrations, influence coefficients, Generalized coordinates, orthogonality principal, matrix iteration method, Rayleigh and Dunkerley, Holzer's, Stodola method, Eigen values and eigen vectors

Unit V: Continuous systems
Lateral vibrations of a string, longitudinal vibrations of bars, transverse vibrations of beams, Euler's equation of motion for beam vibration, natural frequencies for various end conditions, torsional vibration of circular shafts.

Suggested Readings

1. Rao S.S, "Mechanical Vibrations", Pearson Education, 2nd Indian reprint.
2. Ambedkar A.G," Mechanical Vibrations and Noise Engineering", Prentice Hall of India Pvt. Ltd.
3. Kelly, S.G, "Mechanical Vibrations, Theory and applications, Cengage Learning.
4. Thomson, W.T and Dahleh, MD, Padmanabhan, C, Theory of Vibrations with Applications", Pearson Education.
5. Meirovitch, L,"Elements of Vibration Analysis", Tata Mc Graw-Hill.
6. Tongue, B.H, "Principles of Vibration", Oxford Publication.

Course Name: Mechanical Vibration Lab

Course Code: 19011500

Course Outline

1. To verify relation T = 2RÖ (l/g) for a simple pendulum.
2. To determine radius of gyration of compound pendulum.
3. To determine the radius of gyration of given bar by using bifilar suspension.
4. To determine natural frequency of a spring mass system.
5. Equivalent spring mass system.
6. To determine natural frequency of free torsional vibrations of single rotor system.

I. Horizontal rotor
II. Vertical rotor

7. To verify the Dun Kerley's rule.
8. Performing the experiment to find out damping co-efficient in case of free damped torsional vibration
9. To conduct experiment of trifler suspension.
10. Harmonic excitation of cantilever beam using electro-dynamic shaker and determination of resonant frequencies.

Suggested Readings:

1. Mechanical Vibrations", G.K. Grover, Nem Chandand Bros, 6th Edition, 1996.
2. Rao, J. S. (1999). Introductory course on theory and practice of mechanical vibrations. New Age International.

Course Name: Product Design and Development

Course Code: 19011600

Course Outline

Unit I : Introduction to Product Design and Development

Importance of new product-Definition-importance-Development Process. Introduction to PDD, Applications, Relevance, Product Definition, Scope, Terminology. Design definitions, the role and nature of design, old and new design methods, Design by evolution.

Physical reliability & Economic feasibility of design concepts. New product development process and organization. Generic product development process for Market Pull & Push of Products. Modification of this process for other types of products.

Unit II: Morphology of Design

Need analysis- Problem Formulation: Establishing economic existence of need, Need Identification and Analysis, Engineering Statement of Problem, Establishing Target Specification. Divergent, transformation and convergent phases of product design. Design criteria, functional aspects. Aesthetics, ergonomics, form (structure). Shape, size, color. Mental blocks, Removal of blocks, Ideation Techniques. Creativity, Checklist.

Unit III: Generation of Alternatives and Concept Selection

Concept generation- a creative process, Creativity, Road Elects to creative thinking-Fear of criticism and Psychological set. Tools of creativity like brain storming, Analogy, Inversion etc., Creative thinking Process. Concept feasibility and Concept Selection, Establishing Engineering Specification of Products. Brainstorming & Synectics. Morphological techniques.

Unit IV: Management of New Product

Preliminary & detailed design- Design Review: Preliminary design- Identification of subsystems, Subsystem specifications, Compatibility. Detailed design of subsystems, component design, Preparation of assembly drawings. Review of product design from point of view of Manufacturing, Ergonomics and aesthetics.

Unit V: Reliability

Reliability considerations, Bath tub curve, Reliability of systems in series and parallel. Failure rate, MTTF and MTBF. Optimum spares from reliability consideration. Design of displays and controls, Man-Machine interface, Compatibility of displays and controls. Ergonomic aspects. Anthropometric data and its importance in design. Applications of Computers in product design.

Suggested Readings

1. Product Design & Manufacturing – A.K.Chitab & R.C.Gupta, PHI (EEE).
2. The Technology of Creation Thinking – R.P. Crewford – Prentice Hall
3. The Art of Thought – Grohem Walls – Bruce & Co., New York
4. Product Design & Decision Theory – M.K. Starr – Prentice Hall
5. Engg . Product Design -C .D. Cain, Bussiness Books.
6. Industrial design for Engineers –W .H. Mayall, Itiffe. Design Methods – seeds of human futures – J. Christopher Jones, John Wiley & Sons.
7. Human Factor Engg. – Mccormick E.J., Mc GrawHill.
8. Engineering: An Introduction to Creative profession – G.C. Beakley Hw leach, Macmillan.
9. Industrial Design In Engineering – A marriage of Techniques – Charles H . Flurscheim, The Design Council – London.
10. Quality Control & Reliability Analysis – Bijendra Singh, Khanna Publications.

Course Name: Turbo Machines

Course Code: 19011700

Course Outline

Unit I: Introduction

Definition of turbo machine, parts of turbo machines, Comparison with positive displacement machines, Classification, Dimensionless parameters and their significance, Effect of Reynolds number, Unit and specific quantities, model studies. (Note: Since dimensional analysis is covered in Fluid Mechanics subject, questions on dimensional analysis may not be given. However, dimensional parameters and model studies may be given more weightage.)

Thermodynamics of fluid flow: Application of first and second law of thermodynamics to turbo machines, Efficiencies of turbo machines, Static and Stagnation states, Incompressible fluids and perfect gases, overall isentropic efficiency, stage efficiency (their comparison) and polytropic efficiency for both compression and expansion processes. Reheat factor for expansion process

Unit II: Energy exchange in Turbo machines

Euler's turbine equation, Alternate form of Euler's turbine equation, Velocity triangles for different values of degree of reaction, Components of energy transfer, Degree of Reaction, utilization factor, Relation between degree of reaction and Utilization factor, Problems.

General Analysis of Turbo machines: Radial flow compressors and pumps – general analysis, Expression for degree of reaction, velocity triangles, Effect of blade discharge angle on energy transfer and degree of reaction, Effect of blade discharge angle on performance, Theoretical head – capacity relationship, General analysis of axial flow pumps and compressors, degree of reaction, velocity triangles, Problems.

III: Steam Turbines

Classification, Single stage impulse turbine, condition for maximum blade efficiency, stage efficiency, Need and methods of compounding, Multi-stage impulse turbine, expression for maximum utilization factor.

Reaction turbine – Parsons's turbine, condition for maximum utilization factor, reaction staging. Problems.

Unit IV: Hydraulic Turbines

Classification, various efficiencies. Pelton turbine – velocity triangles, design parameters, Maximum efficiency.

Francis turbine - velocity triangles, design parameters, runner shapes for different blade speeds. Draft tubes- Types and functions.

Kaplan and Propeller turbines - velocity triangles, design parameters. Problems.

Unit V: Centrifugal Pumps

Classification and parts of centrifugal pump, different heads and efficiencies of centrifugal pump, Minimum speed for starting the flow, Maximum suction lift, Net positive suction head, Cavitation, Need for priming, Pumps in series and parallel. Problems.

Centrifugal Compressors: Stage velocity triangles, slip factor, power input factor, Stage work, Pressure developed, stage efficiency and surging and problems. Axial flow Compressors: Expression for pressure ratio developed in a stage, work done factor, efficiencies and stalling. Problems.

Suggested Readings

1. Fluid Mechanics and Thermodynamics of Turbomachinery, Fifth Edition [Paperback] S 1. Larry Dixon
2. An Introduction to energy conversion, Volume III – Turbo machinery, V. Kadambi and Manohar Prasad, New Age International Publishers (P) Ltd.

3. "Turbines, Compressors & Fans", S. M. Yahya, Tata-McGraw Hill Co., 2nd Edition (2002).
4. "Principles of Turbo Machinery", D. G. Shepherd, The Macmillan Company (1964)
5. Fundamentals of Turbomachinery: William W Perg, John Wiley & Sons, Inc. 2008.
6. A Text book of Turbo mechanics- M.S. Govindgouda & A.M.Nagaraj-M.M. Publications IV Edition-2008
7. "Turbo Machinaries" B. K. Venkanna, PHI

Course Name: Numerical Methods

Course Code: 19011800

Course Outline

Unit I: Solution of Linear Algebraic Equations
Gaussian elimination, LU decomposition, pivoting strategies, Operation Count, Matrix inversion, special cases-Tridiagonal and block tridiagonal system, Matrix and Vector norms

Unit II: Solution of Non-linear Algebraic Equations
Bisection, Newton-Raphson and Secant method, System of non-linear equations

Unit III: Basics of finite difference method
Discretization of spatial and time derivatives using Taylor's series, Truncation error and order of discretization, Fourier (von Neumann) stability analysis

Unit IV: Solution of Ordinary Differential Equations
Initial Value problems - Euler explicit and implicit methods, Runge-Kutta method, Predictor-Corrector methods, Boundary value problem - Shooting method, Finite difference method applied to pin fin heat dissipation, Stiff Problems-Meaning of stiffness, Further insights into stiffness by the application of Euler explicit and implicit method to a stiff problem, Solution of stiff problem.

Unit V: Solution of Elliptic Partial Differential Equations

Physical problems governed by elliptic PDE's, Five-point and nine-point discretization's of Poisson's equation, Iterative Methods-Point Iterative methods – Jacobi, Gauss-Seidel, and SOR

Suggested Readings

1. Numerical Mathematics and Computing, by Ward Cheney and David Kincaid, International Thomson Publishing Company.
2. Applied Numerical Analysis, by Curtis Gerald and Patrick Wheatley, Addison-Wesley.
3. Analysis of Numerical Methods, by E. Isaacson & H. B. Keller, John Wiley & Sons.
4. Numerical Solution of Partial Differential Equations: Finite Difference Methods, by G. D. Smith, Oxford University Press, 1985.

5. Matrix Computations, by G. H. Golub, Johns Hopkins University Press
6. Numerical Recipes, by W. H. Press et al

Course Name: Numerical Methods Lab

Course Code: 19011900

Course Outline

Write program in C/MATLAB for any 10 of the following numerical methods:

1. Determinant and inverse of a matrix
2. Gauss Elimination Method
3. Gauss Jordan Method
4. LU Decomposition Method
5. Newton-Raphson Method (Single and multivariable function)
6. Least Square Method
7. Lagrangian Interpolation
8. Numerical Differentiation using (a) Newton Forward Difference Method (b) Newton Backward Difference Method (c) Newton Central Difference Method
9. Numerical Integration using Simpson's formula and Trapezoidal formula
10. Explicit Euler method
11. Runge- Kutta 4th Order Method (Single and Simultaneous differential Equations)
12. Finite Difference method to solve ODE-BVPs.

Suggested Readings

1. Mishra, K. K. (2010). *A Handbook on Numerical Technique Lab (MATLAB Based Experiments)*. IK International Pvt Ltd.
2. Siauw, T., & Bayen, A. (2014). An introduction to MATLAB® programming and numerical methods for engineers. Academic Press.Woodford, C., & Phillips, C. (2011). *Numerical methods with worked examples: Matlab edition*. Springer Science & Business Media.
3. Otto, S., & Denier, J. P. (2005). *An introduction to programming and numerical methods in MATLAB*. Springer Science & Business Media.

Course Name: Professional Development

Course Code: 19012100

Objectives

- To acquaint the students with fundamentals of communication and help acquire some of the necessary skills to handle day-to-day professional responsibilities, such as - making speeches, controlling one-to-one communication, enriching group activities and processes
- To enable students to communicate effectively with co-workers, employers, clients , customers and friends

Course Outline

Unit I: Self-Management
Self-Introduction–Expressing Confidently, SWOT Analysis Identifying One's Strengths and Weakness Impromptu speech (welcome, thank you, introducing others) – tackling hesitation, shyness and nervousness in speaking.

Unit II: Work Place Communication
Email Etiquette - Email Message, Netiquette Guidelines
Letter Writing- Job application, introduction, reference, thank you, follow up, appreciation letter
Effective Presentations- Enhancing presentations with slides and other Audio-visual aids - Art of Delivering the presentation

Unit III: Interview and Group Discussion Skills
Different types of Interview format- answering questions- offering information- mock interviews-body language(paralinguistic features)- articulation of sounds- intonation.
Topic Based group discussion, Case based group discussion

Unit IV: Public Speaking
a. Prepared speech (topics are given in advance, students get 10 minutes to prepare the speech and 5 minutes to deliver.
b. Extempore speech (students deliver speeches spontaneously for 5 minutes each on a given topic)
c. Story telling (Student narrates a fictional or real life story for 5 minutes each)

Unit V: English Language Proficiency Test
English proficiency test in the language lab

Suggested Readings:

- Sarvesh Gulati (2012), Corporate Grooming and Etiquette, Rupa Publications India Pvt. Ltd.
- Bovee, Courtland L, Thill, John V. and Abha Chatterjee (2011). *Business Communication Today*, 10/e; New Delhi: Pearson
- Basic Managerial Skills for All by E. H. McGrath, S. J., PHI

Teaching Methods:

- To be totally learner-centric with minimum teacher intervention as the course revolves around practice.
- GD/Interview/Role Play to be conducted in a regular classroom but learners are to be exposed to telephonic, personal and skype interview.

Note: The review of Syllabus happens on periodic basis for the benefit of the students. In case there are changes in curriculum due to review, students would be intimated in writing.

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