**KURUKSHETRA UNIVERSITY, KURUKSHETRA**

(‘A+’ Grade, NAAC Accredited)

**SCHEME OF EXAMINATIONS FOR**

**MASTER OF TECHNOLOGY IN Civil**

**HIGHWAY ENGINEERING**

**(W. E. F. SESSION: 2018-19)**

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| **S. No.** | **Course Code** | **SUBJECT** | L | T | P | **Total** | **Minor****Test** | **Major Test** | **Cr.** | **Duration of Exam (Hrs.)** |
| 1 | MCH-101A | Traffic Engineering | 3 | - | - | 3 | 40 | 60 | 3 | 3 |
| 2 | MCH-103A | Geometric Design of Highways | 3 | - | - | 3 | 40 | 60 | 3 | 3 |
| 3 | MCH-105A | Pavement Materials | 3 | - | - | 3 | 40 | 60 | 3 | 3 |
| 4 | \* | Program Elective-I | 3 | - | - | 3 | 40 | 60 | 3 | 3 |
| 5 | \*\* | Program Elective-II | 2 | - | - | 2 | 40 | 60 | 2 | 3 |
| 6 | MCH-119A | Traffic Lab | - | - | 4 | 4 | 40 | 60 | 2 | 3 |
| 7 | MTRM-111A | Research Methodology and IPR | 2 | - | - | 2 | 40 | 60 | 2 | 3 |
| 8 | \*\*\* | Audit Course-I | 2 | - | - | 2 | 100 | - | 0 | 3 |
|  | **TOTAL** | **18** | **0** | **4** | **22** | **280** | **420** | **18** |  |
|  | **700** |

**SEMESTER-Ⅰ**

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| **\*Program Elective – I** | **\*\*Program Elective- II** |
| MCH-107A | Concrete Technology | MCH-113A | Transport Safety and Environment |
| MCH-109A | Mass Transportation System  | MCH-115A | Low Volume Roads |
| MCH-111A | Transportation Data Analysis | MCH-117A | Highway Subgrade and Foundation Analysis |

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| **\*\*\*Audit Course-I** |
| MTAD-101A | English for Research Paper Writing |
| MTAD-103A | Disaster Management |
| MTAD-105A | Sanskrit for Technical Knowledge |
| MTAD-107A | Value Education |

**Note1:** The course of program elective will be offered at 1/3rd or 6 numbers of students (whichever is smaller) strength of the class.

\*\*\* **Note2:** Along with the credit course, a student may normally be permitted to take audit course, however for auditing a course; prior consent of the course coordinator of the course is required. These courses shall not be mentioned for any award/calculation of SGPA/CGPA in the DMC. A certificate of successful completion of the audit course will be issued by the Director/Head of institution.

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| **S. No.** | **Course code** | **Subject** | **L** | **T** | **P** | **Total** | **Minor****Test** | **Major Test** | **Cr.** | **Duration of Exam (Hrs.)** |
| 1 | MCH-102A | Pavement Analysis and Design | 3 | - | - | 3 | 40 | 60 | 3 | 3 |
| 2 | MCH-104A | Pavement Construction, Maintenance and Management | 3 | - | - | 3 | 40 | 60 | 3 | 3 |
| 3 | MCH-106A | Public Transportation | 3 | - | - | 3 | 40 | 60 | 3 | 3 |
| 4 | \* | Program Elective-III | 3 | - | - | 3 | 40 | 60 | 3 | 3 |
| 5 | MCH-114A | Accidental Analysis | 3 | - | 0 | 3 | 40 | 60 | 3 | 3 |
| 6 | MCH-116A | Road Safety and Audit Lab | - | - | 2 | 2 | 40 | 60 | 2 | 3 |
| 8 | \*\* | Audit Course | 2 |  |  | 2 | 100 | - | 0 | 3 |
|  | **TOTAL** | **17** |  | **2** | **19** | **240** | **360** | **17** |  |
| **600** |

**M.Tech. in Civil (Highway Engg.) : SEMESTER-II**

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| **\*Program Elective – III** |
| MCH-108A | Highway Drainage System |
| MCH-110A | Advanced Methods in Road and Airfield Infrastructure Design |
| MCH-112A | Traffic Management and Intelligent Transport System |

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| **\*\*Audit Course – II** |
| MTAD-102A | Constitution of India |
| MTAD-104A | Pedagogy Studies |
| MTAD-106A | Stress Management by Yoga |
| MTAD-108A | Personality Development through Life Enlightenment Skills. |

**Note1:** The course of program elective will be offered at 1/3rd or 6 numbers of students (whichever is smaller) strength of the class.

\*\***Note2:** Along with the credit course, a student may normally be permitted to take audit course, however for auditing a course; prior consent of the course coordinator of the course is required. These courses shall not be mentioned for any award/calculation of SGPA/CGPA in the DMC. A certificate of successful completion of the audit course will be issued by the Director/Head of institution.

**M.Tech. in Civil (Highway Engg.) : SEMESTER-Ⅲ**

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| **S. No.** | **Course Code** | **Subject** | **L** | **T** | **P** | **Total** | **Minor****Test** | **Major Test** | **Cr.** | **Duration of Exam (Hrs.)** |
| 1 | \* | Program Elective-IV | 3 | - | - | 3 | 40 | 60 | 3 | 3 |
| 2 | \*\* | Open Elective | 3 | - | - | 3 | 40 | 60 | 3 | 3 |
| 3 | MCH-207A | Dissertation Phase-I | - | - | 18 | 18 | 100 | - | 11 | 3 |
|  |  | **TOTAL** | **6** |  | **18** | **24** | **180** | **120** | **17** |  |
|  | **300** |  |  |

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| **\*Program Elective – IV** |
| MCH-201A | Highway Planning |
| MCH-203A | Road Transport Regulation and Administration |
| MCH-205A | Design and construction of Bridges and Flyovers |

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| **\*\*Open Elective** |
| 1. | MTOE-201A | Business Analytics |
| 2. | MTOE-203A | Industrial Safety |
| 3. | MTOE-205A | Operations Research |
| 4. | MTOE-207A | Cost Management of Engineering Projects |
| 5. | MTOE-209A | Composite Materials |
| 6. | MTOE-211A | Waste to Energy |

**M.Tech. in Civil (Highway Engg.): SEMESTER-IV**

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| **S. No.** | **Course Code** |  | **L** | **T** | **P** | **Total** | **Minor****Test** | **Major Test** | **Cr.** | **Duration of Exam (Hrs.)** |
| 1 | MCH-202A | Dissertation Phase-II | - | - | 32 | 32 | 100 | 200 | 16 | 3 |
|  | **TOTAL** | **300** | **16** |  |

 **Total credits of all four semesters – 68**

**Note 1**:At the end of the second semester each student is required to do his/her Dissertation work in the identified area in consent of the Guide/Supervisor. Synopsis for the Dissertation Part-I is to be submitted within three weeks of the beginning of the Third Semester.

**Note 2**: Each admitted student is required to submit the report of his/her Dissertation Part-I as per the schedule mentioned in Academic calendar for the corresponding academic session otherwise the Dissertation Part-II cannot be continued at any level.

**Note 3**: Each admitted student is required to submit his/her final Dissertation Part-II as per the schedule mentioned in Academic calendar for the corresponding academic session only after the publication of two papers in a journal/International/National conference of repute like IEEE, Springer, Elsevier, ACM etc.

**Note 4:** The course of program/open elective will be offered at 1/3rd or 6 numbers of students (whichever is smaller) strength of the class.

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|  |  |  | **MCH-101A :Traffic Engineering** |  |
| L | T P/D | Credits |  Max. Marks: 100 |
| 3 |  | 3 | Major Test  | : 60 Marks |
|  |  |  | Minor Test  | : 40 Marks |
|  |  |  | Duration | : 3Hours |

UNIT-I

Traffic Characteristics: Importance of traffic characteristics , road user characteristics , vehicular characteristics. Max dimensions and weights of vehicles allowed in India. Effects of traffic characteristics on various design elements of the road.

Traffic Studies: Traffic volume study, speed study and origin and destination study. Speed and delay study. Use of photographic techniques in traffic surveys.

UNIT-II

Traffic Accidents: Accident surveys. Causes of road accidents and preventive measures . Capacity and level of Service, fundamental diagram of traffic flow. Relationship between speed, volume and ciensity. PCU. Design service volume. Capacity of non-urban roads. IRC recommendations. Brief review of capacity of urban roads.

UNIT- III

Traffic Regulation and Control Devices: Traffic control devices: signs , signals, markings and islands. Types of signs. Types of signals. Design of signal by IRC method. Intersections at grade and grade separated intersections. Design of a rotary. Types of grade separated intersections.

Design of Parking Lighting and Terminal Facilities: Parking surveys. On street parking. Off street parking.

UNIT-IV

Traffic Regulation: Need and scope of traffic regulations. Regulation of speed, vehicles and drivers. · General traffic regulations. Motor vehicle act. Scope of traffic management.

**Recommended Books**

1. Principles of Transportation Engineering by Chakraborty & Das, Prentice Hall, India.
2. Highway Engg by S.K.Khanna & C.E.G. Justo, New Chand Bros., Roorkee.
	* + 1. Principles and Practice of Highway Engg. By L.R.Kadiyali , Khanna Publishers , Delhi.
		1. Principles of Transportation and Highway Engineering by G.V.Rao, Tata McGraw-Hill Publishing Co. Ltd. N. Delhi.
	1. MORTH Specifications for Road and Bridge Works, IRC Publication.

**MCH-103A : Geometric Design of Highways**

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P/D

Credits

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Max. Marks : 100

Major Test : 60 Marks

Minor Test : 40 Marks

Duration :3Hours

UNIT -I

Highway Alignment: Requirements. Factors controlling alignment. Obligatory points. Engineering surveys for highway location. Route selection. Steps in new project. Highway classifications.

Cross Sectional Element: Pavement surface characteristics. Factors affecting skid resistance. Pavement unevenness. Camber. Providing camber in the field. Width of carriageway. Design Vehicle , medians, kerbs, road margins, right of way and typical cross sections of roads.

UNIT -II

Sight Distances: Introduction. Stopping sight distance. Reaction time. Analysis of stopping distance .

Overtaking sight distance. Analysis of overtaking sight distance. Effect of grade on sight distances.

Overtaking zone. Intermediate sight distance. Sight distance at intersections.

Superelevation: Requirement of superelevation. Limits and attainment of superelevation in the field.

UNIT-III

Highway Alignment: General. Design speed. Horizontal curves. Superelevation. Analysis of superelevation. Superelevation design. Attainment of superelevation. Widening of pavement on horizontal curves. Methods of introducing extra widening. Horizontal Transition curves. Different types of transition curves. Length of transition curve. Setting out of transition curve. Set-back distance on horizontal curves. Curve resistance.

UNIT-IV

Vertical Alignment: General. Gradients. Compensation in gradient on horizontal curves. Vertical curves. Summit curve. Length of summit curve. Valley Curve. Length of valley curve and profile. Relevant IRC standards for urban and rural roads.

**Recommended Books**

1. Principles of Transportation Engineering by Chakraborty & Das, Prentice Hall, India.
2. Highway Engg.by S.K.Khanna & C.E.G. Justo, New Chand Bros., Roorkee.
3. Principles and Practice of Highway Engg.by. L.R.Kadiyali, Khanna Publishers, Delhi.
4. Principles of Transportation and Highway Engineering by G.V.Rao, Tata McGraw-Hill Publishing Co. Ltd. N. Delhi.
5. MORTH Specifications for Road and Bridge Works, IRC Publication.
6. Principles of Highway Engineering and Traffic Analysis, by Mannering, F., W. Kilareski, and S. Washburn 3rd Edition, John Wiley and Sons, 2005.

**MCH-105A: Pavement Materials**

L T P/D Credits Max. Marks : 100

3 3 Major Test : 60 Marks

Minor Test : 40 Marks

Duration :3Hours

UNIT-I

Subgrade: Significance of subgrade soil. Characteristics of soil. Desirable properties. Index properties of Soil. Soil classification based on grain size. Soil classification system. Evaluation of soil strength. Aggregates: Introduction . Desirable properties of road aggregates. Tests for road aggregates.

UNIT-II

Bituminous Materials: Introduction. Types of bituminous materials. Tests on bitumen . Cutback and

emulsions .Bituminous Paving Mixes: Design of bituminous mix. Marshal method of bituminous mix design.

UNIT-III

Polymer and Rubber Modified characterization. Performance based bituminous mixture.

Binders: Physical and chemical properties. Fly ash and its mix design Approaches. Visco elastic properties of bitumen and

UNIT-IV

Construction Methods: Bituminous and concrete pavements . Relevant IS and IRC codes.

**Recommended Books**

1. Principles of Transportation Engineering by Chakraborty & Das, Prentice Hall, India.
2. Highway Engg by S.K.Khanna & C.E.G. Justo, New Chand Bros., Roorkee.
	1. Principles and Practice of Highway Engg. By L.R.Kadiyali, Khanna Publishers , Delhi .
	2. Principles of Transportation and Highway Engineering by G.V.Rao, Tata McGraw-Hill Publishing Co. Ltd. N.Delhi .
3. MORTH Specifications for Road and Bridge Works, IRC Publication.

**MCH-107A: Concrete Technology**

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| L | T P/D | Credits | Max. Marks: 100 |
| 3 |  | 3 | Major Test  | : 60 Marks |
|  |  |  | Minor Test  | : 40 Marks |
|  |  |  | Duration | :3 Hours |

UNIT-I

Concrete as Pavement Material: Introduction. Preparation and grade of concrete.

Concrete Ingredients: Types of cement. Aggregates. Classification of aggregate. Properties of aggregate. Quality of mixing water. Admixtures.

UNIT-II

Properties of Concrete: Introduction, workability, stress strain characteristics of concrete, yo ung's modulus of concrete, creep and shrinkage of concrete, permeability, durability of concrete, joints.

UNIT-III

Production of Concrete: Batching, mixing, transportation , compaction , vibration, curing, formwork removing. Ready mixed concrete.

Non-Destructive Testing of Concrete: Significance. Rebound hammer. Ultrasonic pulse velocity technique. Penetration technique. Pullout test. Cover meter. Core tests.

UNIT-IV

Deteriorations: Causes, deteriorations b y water, surface we1r, frost action, chemical Reaction, corrosion of reinforcement etc, preventive measures.

Advances in Concrete: Introduction to light weight concrete. High strength concrete. Prestressed concrete. Fibre reinforced concrete. Polymer concrete composites.

**Recommended Books:**

1. M.L.Gambhir, "Concrete Technology" TMH Pub. N Delhi.
2. Shetty M.S. "Concrete Technology" S. Chand & Co. N Delhi.

**MCH- 109A: MASS TRANSPORTATION SYSTEMS**

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| L  |  T P/D | Credits  |  Max.Marks  |  :100 |
| 3 |  0 | 3  |  Major Test  |  :60 Marks |
|  |  |  |  Minor Test :40 Marks Duration :3Hours  |
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UNIT I

Role of Transportation: History of transit, Recent Trends in transit, Mass transportation characteristics, Demand Characteristics: Spatial, temporal and behavioral characteristics.

Mass Transportation Planning: Transportation demand surveys, Mass transportation demand estimation, Demand projection, Trip generation, Trip distribution, Model split and route assignment. Bus scheduling, Transit corridor identification.

UNIT II

Transport system Performance: Performance evaluation and analysis, Structure of decision making, Evaluation and selection methods, and selection procedure.

Generation of alternative schemes, Economic evaluation methods.

UNIT III

Terminals: Public transport infrastructures, Functions of terminals, Design, Typical Terminal characteristics.

Scheduling and Routes: Service analysis, Vehicle dispatch policy, Vehicle Requirements, Spacing of bus stops, Route spacing and performance.

UNIT IV

Management: Operational and management issues in transport planning, integration of public transport modes, Reserved bus lanes and signals, Vehicle monitoring and control system, Nodal coordination. BRT corridors.

Special Systems: Multimodal transport systems, People mover systems, Underground transportation, para transit, Rail transit system, case studies.

**REFERENCE BOOKS**:

1. Khisthy, Lal, Transporation Engineering, PHI, Delhi, 2008 Hay, W.W., An Introduction to Transportation Engineering, 2nd Ed., John Wiley & Sons, 2001
2. Kadiyali, L. R, “Traffic Engineering and Transport Planning”, Khanna Publishers New Delhi – 110006, 2006
3. Hutchinson, Urban Transport Planning, John Wiley, 2006
4. Dickey, J.W., et. al., Metropolitan Transportation Planning, TMH edition, 2002.
5. Paguette, R.J., et.al, Transportation Engineering - Planning and design, 2nd Ed., John Wiley & Sons.
6. Railis, V.R, Intercity Transport, Engineering and Planning, The Macmillan Press, 2003.

**MCH-111A: Transportaion Data Analysis**

L T P/D Credits Max Marks :100

3 0 3 Major Test :60 Marks

 Minor Test :40 Marks

 Duration :3Hours

UNIT I

Multivariate Data Analysis Techniques: Types of Data, Basic Vectors and Matrices, Sample Estimate of Centroid, Standard Deviation, Dispersion, Variance and Covariance, Correlation Matrices, Principle Component, Factor Analysis, ANOVA and Cross Classification Procedure in Multivariate Data Analysis and Application to Problems in Traffic and Transportation Planning.

UNIT II

Analysis and Modeling of Travel Choices: Fundamentals of Micro-Economic Demand Theory – Choice Function – Direct and Cross Elasticity of Demand – Properties of some Empirically Derived Demand Functions – Market Demand; Theory of Behavioral Models, Deterministic and Stochastic Models, Random Utility Model, Probit, Logit and Descriminant Model Formulations for Mode and Route Choices, Implications; Value of Travel Time Studies.

UNIT III

Concept of Entropy and its Application in Travel Demand Modeling: Definition of Entropy, its relations to Probability and Uncertainty, Entropy of Probability Distribution, Entropy and Bayesian Statistics, Application of Entropy Concepts in Transport Models: Theory of Trip Distribution, Mode Split and Route Split, Production, Attraction, Doubly Constrained Gravity Models and Derivation of Intervening Opportunity Model, Missing Information and Use of Entropy in Travel Demand Modeling: Entropy and Information Theory Approaches for Estimating the Travel Demand using Indirect Methods such as Use of Link Volume Counts, Turning Counts,

UNIT IV

Forecasting using Time Series Analysis: Basic Components of Time Series – Stationery and Non-Stationery Processes- - Smoothing and Decomposition Methods – Correlation and Line Spectral Diagrams – Auto Correlations and Moving Averages; Introduction to Box-Jenkins Forecasting

**REFERENCE BOOKS:**

1. Cooley, WW and Lohnes, RR, Multi-variate Data Analysis, John Wiley.
2. Richard A. Johnson, Dean W. Wichern, Applied Multivariate Statistical Analysis, Prentice Hall.
3. Simon P. Washington, Matthew G. Karlaftis & Fred L. Mannering, Statistical and Econometric Methods for Transportation Data Analysis, Chapman & Hall/CRC.
4. Kanafani, A., Transportation Demand Analysis, McGraw-Hill.
5. Michael Meyer, Eric J Miller, Urban Transportation Planning, McGraw-Hill
6. Spyros G. Makridakis, Steven C. Wheelwright, Rob J Hyndman, Forecasting : Methods and Applications, Wiley.

**MCH-113A: Transportation Safety and Environment**

L T P/D Credits Max. Marks :100

2 2 Major Test :60 Marks

 Minor Test :40 Marks

 Duration :3 Hours

UNIT-I

Trends in roads and highways development. Problem of road accidents in India. Characteristics of road accidents. Causes of accidents. Global and Indian road safety scenario. Factors responsible for success stories in road safety. Role of highway professionals in highway safety.

UNIT-II

Planning of roads for safety. Land use planning and zoning. Development control and encroachment. Network hierarchy. Route planning through communities. Access control. Traffic segregation. Traffic calming designing for safety: road link design, alignment design. Cross-sectional elements.

Traffic control devices. Road side safety. Road side facilities. Some critical elements. Junction design. Basic principles. Selection of junction type. Factors affecting safety at various junction types. Elements to improve road safety. Provisions for vulnerable road users.

UNIT-III

Road safety audit. Concepts of road safety audit, Road safety auditors & key personnel in RSA. Organizing and conducting a road safety audit. Example and commonly identified. Issues during RSA, Road safety audit report. Development of cost-effective of road safety audit accident investigation and prevention. Basic strategies for accident reduction. Significance of accident data. Accident investigation and identification of potential sites for treatment. Problem diagnosis. Selection of countermeasures. Example of selection of counter measures. Detailed design and implementation of countermeasures.

UNIT-IV

Monitoring and evaluation non-engineering measures for road safety, behavioral counter measures , education. Training and publicity. The goal of police traffic control activities. Strategy for road safety management by police. Role of NGOs in road safety. Legal framework for road safety transport related pollution, noise pollution, air pollution, effects of weather conditions, vehicular emission parameters, pollution standards. EIA requirements of highway projects, world bank guidelines, EIA practices in India. Fuel crisis and transportation, factors affecting fuel consumption, fuel economy in various modes of transportation, various types of alternative fuels.

**Recommended Books:**

1. Traffic Engg. And Transport Planning by L.R.Kadiyali, Khanna Publishers, Delhi.
2. Highway Engg. By S.K.Khanna& C.E.G. Justo, New Chand Bros., Roorkee.

**MCH- 115A: Low Volume Roads**

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| L |  T P/D | Credits | Max Marks |  :100 |
| 2 |  0 | 2 | Major Test  |  :60 Marks |
|  |  |  | Minor Test :40 Marks Duration :3Hours |
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UNIT I

Planning of rural road net work – Concept of core and non-core roads, general principle, guidelines laid down in recent 20-year plans and in PMGSY

Guidelines for alignment and geometric design of rural/low volume roads and safety aspects.

UNIT II

 Investigations and surveys, soil and material surveys, Promoting use of alternate margina/ low cost waste / stabilized local materials in rural road works, fly ash in fill and other layers, use of other waste materials. Soil stabilization methods – mechanical, soil cement, soil lime, soil-lime-pozzolana, soil-lime-cement stabilization

UNIT III

Design of different types of pavements for rural roads, choice of pavement type / pavement materials. Guidelines and specifications by IRC, NRRDA and MORD

Road drainage – study of requirements of surface and subsurface drainage, and cross drains, standard design of culverts and small bridges

UNIT IV

Specifications and steps for the construction of different components of rural / low volume roads including pavement layers, quality control during construction

Maintenance of rural roads – shoulders, side and cross drains. Pavement distress, different types of failures and maintenance measures. Preventive maintenance works.

**REFERENCE BOOKS:**

1. CRRI “Low Volume Roads’ Central Road Research Institute”-New Delhi
2. IRC “Rural Roads Manual”-Special Publication 20 – 2002, Indian Roads Congress.
3. IRC SP- 26 “Report Containing Recommendations of IRC Regional Workshops on Rural Road Development”- 1984, Indian Roads Congress
4. IRC SP:42 –1994, “Guidelines on Road Drainage”- Indian Roads Congress
5. IRC SP: 58-2001, “Guidelines for Use of Fly Ash in Road Embankments”- Indian Roads Congress
6. MoRTH “Specifications for Road and Bridge Works”- 2001, fourth revision, Indian Roads Congress
7. MORD “Specification for Rural roads”

**MCH- 117A: Highway Subgrade and Foundation Analysis**

L T P/D Credits Max Marks :100

2 0 2 Major Test :60Marks

 Minor Test :40Marks

 Duration :3 Hrs

UNIT I

 Introduction: Soil Mechanics applications to Highway Engg. Soil formations, Types, Regional Soil deposits of India, Index properties, their determination, importance, various soil classification systems, HRB classification, problems. Soil Compaction: Introduction, Lab Tests, Factors affecting, Structure & Engg behavior of compacted cohesive soil, Field compaction specifications Filed compaction control, Different types of Equipments used for compaction, their choice.

UNIT II

Shear strength of soil: Introduction, Importance, Measurements, shear strength of clay, Sand, Elastic properties of soil – Tangent, Secant modulus, Stress – Strain curves, Poisson’s ratio, Shear Modulus. Stability of slopes: Introduction, Types, Different methods of analysis of slopes for Øu+0 & C-Ø soil, Location of most critical circle, Earth dam slopes stability, Taylor’s stability number. Effect of Earthquake Force, problems on above.

UNIT III

Permeability of soil: Darcy’s Law, Validity, Soil-water system, Types, Determination of permeability, problems. Site Investigation: Introduction, Planning exploration programmes, Methods, Samplers, SPT, Subsoil investigation Report, Geophysical methods.

UNIT IV

Highway Drainage: Introduction, Importance, Surface drainage, Sub-surface drainage, methods, Design of subsurface drainage system, Road construction in water logged areas, Land slides – definition, classifies, factors producing. Reinforced Earth structures: Introduction , Components, Advantages, Types of stability – external, Internal, (No problems), Geo textiles – types, Functions, their uses in road embankments and railway works, other uses.

**REFERENCE BOOKS**:

1. “Basic and Applied soil Mechanics”, Gopal Ranjan, ASR Rao, New Age International Publishers 2. “Soil Mechanics & Foundation Engg”, Dr.B.C. Punmia, Ashok Kumar Jain, Arun Kumar Jain, Laxmi Publications (P) Ltd, 16th edition. 3. “Highway Engg”, S.K. Khanna, C.E.G. Justo, 5th edition. 4. “Soil Mechanics & Foundation Engg” – K.R. Arora Standard Publishers Distributors. 5. “Soil Mechanics for road Engineers” – HMSO, London.

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|  |  | **MCH-119A: Traffic lab** |  |
| L T P/D | Credits  | Max. Marks | : 100 |
| 4 | 2 |  Major Test | : 60 Marks |
|  |  |  Minor Test  | : 40 Marks |
|  |  | Duration | : 3 Hours |

**LIST OF PRACTICALS:**

* 1. Traffic volume study using videography technique .
1. Traffic speed study using videography technique.
2. Speed study by radar gun
3. Speed study by endoscope
4. Determination of reaction time of driver
5. Parking study
6. Accident investigation study
7. Study for improvement of an accident prone location

9. Bitumen content determination through centrifuge extrude.

10. Proportioning of aggregate

**MTRM-111A : Research Meathodology and IPR**

L T P/R Credits Max. marks : 100

2 2 Major Test : 60 Marks

 Minor Test : 40 Marks

 Duration : 3 Hours

**Unit 1**

Meaning of research problem, Sources of research problem, Criteria Characteristics of a good research problem, Errors in selecting a research problem, Scope and objectives of research problem. Approaches of investigation of solutions for research problem, data collection, analysis, interpretation, Necessary instrumentations

**Unit 2**

Effective literature studies approaches, analysis, Plagiarism, Research ethics, Effective technical writing, how to write report, Paper.Developing a Research Proposal, Format of research proposal, a presentation and assessment by a review committee.

**Unit 3**

Nature of Intellectual Property: Patents, Designs, Trade and Copyright. Process of Patenting and Development: technological research, innovation, patenting, development. International Scenario: International cooperation on Intellectual Property. Procedure for grants of patents, Patenting under PCT.

**Unit 4**

Patent Rights: Scope of Patent Rights. Licensing and transfer of technology.Patent information and databases.Geographical Indications.

New Developments in IPR: Administration of Patent System. New developments in IPR; IPR of Biological Systems, Computer Software etc.Traditional knowledge Case Studies, IPR and IITs.

**Recommended Books** :

1. Stuart Melville and Wayne Goddard, “Research methodology: an introduction for science & engineering students’.
2. C.R. Kothari, “Research Methodology: Methods & Techniques, 2nd edition or above, New Age Publishers.

2. Wayne Goddard and Stuart Melville, “Research Methodology: An Introduction”

3. Ranjit Kumar, 2 ndEdition , “Research Methodology: A Step by Step Guide for beginners”

4. Halbert, “Resisting Intellectual Property”, Taylor & Francis Ltd ,2007.

5. Mayall , “Industrial Design”, McGraw Hill, 1992.

6. Niebel , “Product Design”, McGraw Hill, 1974.

7. Asimov , “Introduction to Design”, Prentice Hall, 1962.

8. Robert P. Merges, Peter S. Menell, Mark A. Lemley, “ Intellectual Property in New Technological Age”, 2016.

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|  |  |  | **MCH-102A :Pavement Analysis & Design** |  |  |
| L | T P/D | Credits | Max. Marks |  :100 |  |
| 3 |  | 3 | Major Test  |  :60 | Marks |
|  |  |  | Minor Test  |  :40 | Marks |
|  |  |  | Duration |  :3Hours |

UNIT-I

Pavement Types: Definition, highway and airport pavement comparison, wheel loads, tyre pressure, contact pressure, design factors. Type of distresses structural and functional, serviceability.

UNIT-II

Stresses in Flexible: Layered system concept, multilayered solutions. Burmister 's method, fundamental design concepts.

Stresses in Rigid Pavements: Relative stiffness of slabs. Modulus of subgrade reaction . Stresses due to warping, stresses due to friction, effect of warping, contraction and expansion. Plain versus reinforced pavements, stresses in dowel bar, tie bar, combined stresses.

UNIT-III

Design of Flexible Pavements: Design factors. Design wheel load. Equivalent single wheel load. Difference between airport and highway design concept. Different design methods . Examples of comprehensive design process . AASHTO method. McLeod method. New IRC Code method.

UNIT-IV

Design of Rigid Pavement: General design considerations. Design of join ts in cement concrete pavements , spacing of expansion joint, spacing of contraction joints. Design of dowel bar. Design of tie bar. IRC recommendations for design of concrete pavements.

Pavement Evaluation and Rehabilitation: Pavement distresses in flexible and rigid pavements , condition and evaluation survey. Present serviceability index. Methods of measuring condition, skid resistance. Principles of maintenance. Methods of structural evaluation.

**Recommended Books:**

1. Principles of Transportation Engineering by Chakraborty & Das, Prentice Hall, India.
	1. Principles ofPavement Design, by Yoder E.J. and Witczak M.W. 2nd, John Wiley & Sons, INC.
	2. Principles and Practice of Highway Engg. By L.R.Kadiyali , Khanna Publishers, Delhi.
	3. Principles of Transportation and Highway Engineering by G.V.Rao, Tata McGraw-Hill Publishing Co. Ltd. N. Delhi.
2. MORTH Specifications for Road and Bridge Works, IRC Publication.

**MCH-104A: Pavement Construction, Maintenance & Management**

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T P/D

Credits

3

Max. Marks : 100

Major Test : 60 Marks

Minor Test : 40 Marks

Duration :3Hours

UNIT-I

Introduction: History of road construction, stages of construction, seasonal limitations of pavement construction.

Stabilization of Soil: Mechanical stabilization, cementing additives and chemicals , thermal stabilization

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UNIT-II

Construction of Non-bituminous Pavements: Brief introduction to earthwork machinery: shovel, hoe, clamshell, dragline, bulldozers, cleaning and grubbing, excavation for road and drain, principles of field compaction of embankment I subgrade. Compacting equipments. Granular roads . Construction steps of GSB, WBM and WMM.

Construction of Bituminous Pavements: Various types of bituminous constructions. Prime coat, tack coat, seal coat and surface dressing. Construction of busg, premix carpet, BM, DBM and AC. Brief coverage of machinery for construction of bituminous roads: bitumen boiler, sprayer, pressure distributer, hot-mix plant, cold-mix plant, tipper trucks, mechanical paver or finisher, rollers. Mastic asphalt. Introduction to various IRC and MORTH specifications.

UNIT -III

Construction of Cement Concrete Roads: Construction of cement concrete pavements , machinery involved in construction, slip-form pavers, joints in cement concrete pavements, IRC and MORTH specifications. Construction of other types of pavements: basic concepts of the following: soil stabilized roads, use of gee-synthetics, reinforced cement concrete pavements, prestress concrete pavements, roller compacted concrete pavements and fibre reinforced concrete pavements. Use of fly ash in cement concrete road construction.

UNIT-IV

Highway Maintenance: Pavement distresses, Maintenance operations, Maintenance of WBM, bituminous surfaces and cement concrete pavements. Functional and structural . evaluation of pavements, pavement maintenance, maintenance management

Related Topics: Emulsified bituminous mix, precoating of aggregates, recycling of bituminous pavements, shoulder construction.

**Recommended Books**

1. Principles of Transportation Engineering by Chakroborty & Das, Prentice Hall, India.
2. Highway Engg. By S.K.Khanna & C.E.G. Justo, New Chand Bros., Roorkee .

**MCH-106A: Public Transportation**

L T P/D

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Credits

3

Max. Marks : 100

Major Test : 60 Marks

Minor Test : 40 Marks

Duration

:3Hours

UNIT-I

Modes of public transportation and application of each to urban travel needs.

UNIT-II

Transit system operations, para-transit systems, street transit systems, rapid transit systems, estimation of transit demand. Route development, properties of a good route set, determination of a good route set, stop location and stopping policy, schedule development, properties of a good schedule, determination of a good schedule.

UNIT-III

Capacity of rapid transit systems, line capacity of RTS, capacity of street transit systems. Transit corridor, identification and planning, mass transport management measures, integration of public transportation modes. Public transport infrastructure, case studies, multi mode transportation system.

UNIT-IV

Planning for public transport, fares and subsidies. Intermediate public transport in Indian cities, types of IPT vehicles. Characteristics of IPT modes.

**Recommended Books:**

1. Traffic Engg. And Transport Planning by L.R.Kadiyali, Khanna Publishers, Delhi.
2. Introduction to Transport Planning by Bruton, M.J., Hutchinson Technical Education, London.
3. Principles of Transportation Engineering by Chakroborty & Das, Prentice Hall, India.

**MCH-108A: Highway Drainage System**

L T P/D Credits Max marks :100

3 3 Major Test : 60 Marks

 Minor Test : 40Marks

 Duration : 3 hours

UNIT-I

Introduction, Importance of drainage, Type of Road Drainage, General Criterion for Road Drainage.

Systems of Drainage: Surface and sub-surface drainage systems.

UNIT-II

Internal drainage of pavement structure, components of surface drainage system, surface drains, road side drains, catch water drains, geometric drainage with transverse drains, horizontal drains, sub surface drain in heavy clayey soil, sub surface drain at valley curve I change of grade, capillary cut-off.

UNIT-III

Design of surface drainage and subsurface drainage system: Hydrologic analysis, hydraulic analysis, data for drainage design, design steps.

UNIT-IV

Cross Drainage, Sub surface drainage, lowering of water table, control of seepage flow, control of capillary rise, design of filter material, drainage of slopes and erosion control, road construction in water logged areas. Drainage in hill road. Drainage systems for Airport and Railways.

**Recommended Books:**

1. Highway Engg by S.K. Khanna & C.E.G Justo, Nem Chand Bros., Roorkee.
2. Principles and Practive of Highway Engg by L.R. Kadiyali , Khanna Publishers , Delhi.
3. Rural Road Mannual, IRC SP-20

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|  |  |  | **MCH- 110A: Advanced Methods for Airport Infrastructure Design** L T P/D Credits Max Marks :100  3 0 3 Major Test :60Marks Minor Test :40Marks  Duration :3 Hours UNIT IIntroduction: Growth of air transport, airport organization and associations, Classifications of airports airfield components, airport traffic zones and approach areas. Aircraft Characteristics Related to Airport Design: Components, size turning radius, speed, airport characteristicsUNIT IICapacity and Delay: Factors affecting capacity, Determination of runway capacity related to delay, gate capacity, taxiway capacity Airport planning and surveys: Runway length and width, sight distances, longitudinal and transverse grades, runway intersections, taxiways, clearances, aprons, numbering, holding apron. UNIT III Design of the Terminal area: Operational concepts, space relationships and area requirements, noise control, vehicular traffic and parking at airports. Airport Grading and Drainage: Grading of airport area, hydrology, design of drainage systems, construction methods, layout of surface drainage and subsurface drainage system. UNIT IVAir Traffic Control and Aids: Runways and taxiways markings, dayand night landing aids, airport lighting and other associated aids. **REFERENCE BOOKS**: 1. “Planning and Design of Airports” - Robert Horenjeff, 2nd edition, McGraw Hill Book Co. 2. “Airport Engineering”- G. Glushkov, V.Babkov, Mir Publuishers, Moscow. 3. “Airport Planning and Design”- Khanna, Arora and Jain, Nem Chand and Bros., Roorkee 4. Harry.R.Cedergern. “Drainage of Airfield pavements”- John Wiley and Sons. 5. Virender Kumar and Satish Chandra, “Airport Planning and Design”- Galotia Publication press. **MCH- 112A: Traffic Management and Intelligent Transportation Systems**

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| L  | P/D | Credits | Max Marks | :100 |
| 3 |  | 3 | Major Test  | :60Marks |
|  |  |  | Minor Test :40MarksDuration :3Hours |
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UNIT IIntroduction to Intelligent Transportation Systems (ITS) –Definition of ITS and Identification of ITS Objectives, Historical Background, Benefits of ITS - ITS Data collection techniques – Detectors, Automatic Vehicle Location (AVL), Automatic Vehicle Identification (AVI), Geographic Information Systems (GIS), video data collection.UNIT IITelecommunications in ITS – Importance of telecommunications in the ITS system, Information Management, Traffic Management Centres (TMC). Vehicle – Road side communication – Vehicle Positioning System ITS functional areas – Advanced Traffic Management Systems (ATMS), Advanced Traveler Information Systems (ATIS), Commercial Vehicle Operations (CVO), Advanced Vehicle Control Systems (AVCS), Advanced Public Transportation Systems (APTS), Advanced Rural Transportation Systems (ARTS).UNIT IIIITS User Needs and Services – Travel and Traffic management, Public Transportation Management, Electronic Payment, Commercial Vehicle Operations, Emergency and incident Management, Advanced Vehicle safety systems, Information Management.UNIT IVAutomated Highway Systems - Vehicles in Platoons – Integration of Automated Highway Systems.ITS Programs in the World – Overview of ITS implementations in developed countries, ITS in developing countries.**REFERENCE BOOKS:**1. ITS Hand Book 2000: Recommendations for World Road Association (PIARC) by Kan Paul Chen, John Miles.
2. Sussman, J. M., Perspective on ITS, Artech House Publishers, 2005.
3. National ITS Architecture Documentation, US Department of Transportation, 2007 (CD-ROM).

**MCH-114A : Accidental Analysis**L T P/D Credits Max Marks :1003 3 Major Test :60Marks Minor Test :40Marks Duration :3 HoursUNIT IIntroduction to Road Safety Engineering and Accident Investigation, [Factors Relating to Accidents,](file:///G%3A/RSA%20course%20material/day%201/1.7%20Human_Factors.pdf) various forms of recording of accident data, study of IRC recommended recording proforma.UNIT II[Accident Investigation & Crash Problem Diagnosing:](file:///G%3A/RSA%20course%20material/day%201/1.8A%20%26%201.8BSteps%20in%20Crash%20Investigation.pdf) investigation at site, various driver related tests, calculation of post crash speed from skid marks, collision and condition diagrams, and traffic and speed studies.UNIT III[Accident Costing,](file:///G%3A/RSA%20course%20material/day%201/1.10%20Crash%20Costs.pdf) [Economic Appraisal:](file:///G%3A/RSA%20course%20material/day%201/1.11A%20%261.11%20B%20Eco%20Exercise.pdf) various methods of calculation of accident costs, their advantages and disadvantages, case studies.UNIT VICrash Problems into Solutions: research and development in accident analysis, issues and challenges in modeling of road accidents, Smeed’s model, Base line models, General ADT models, Models with covariates, AMFs, various measures to improve road safety, before and after studies.**REFERENCE BOOKS:**1. Highway Engineering by Khanna and Justo, Nem Chand & Brothers, Roorkee
2. Kadiyali, L.R., `Traffic Engineering and Transport Planning', Khanna Publications.
3. Pignataro, Louis, `Traffic Engineering - Theory and Practice', John Wiley.
4. RRL, DSIR, `Research on Road Safety', HMSO, London.
5. Papacoastas ‘Introduction to Transportation Engineering’ –Prentice

**MCH-116A: ROAD SAFETY AND AUDIT LAB** L P/D Credits Max. Marks :100  2 2 Major Test :60 Marks  Minor Test : 40 Marks Duration of Exam :3 Hrs **List of experiments**: 1. Design stage audit: Study of project Drawings to identify safety concerns 2. Site Visits for Construction stage audit 3. Site Visits for existing road audit 4. Site Visits and Preparation of the Audit Reports 5. Visit to accident site 6. Compilation of FIR data and study of its limitations 7. Identification of black spots from FIR data 8. Study of accident recording forms    |  |
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P/D

Credits

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**MCH-201A: Highway Planning**

Max. Marks : 100

Major Test : 60 Marks

Minor Test : 40 Marks

Duration :3 Hours

UNIT-I

Transport Planning Process : Status of transportation in India. Objectives and scope of transport planning. Urban, regional and national transport planning. Transport planning process, various stages. Land use and traffic.

UNIT-II

Transportation Survey: Definition of study area. Zoning. Types of surveys. 0-D surveys. Inventories of existing transport facilities, land use and economic activities. TRIP.

Generation: Trip purpose. Factors affecting trip generation. Trip generation estimation by multiple linear regression analysis, brief review of category analysis, advantages and limitations of these methods.

UNIT-III

Trip Distribution: Methods of trip distribution. Basic concepts of uniform factor method , average factor method and opportunity model. Trip distribution by gravity model.

Traffic Assignment: Principles of assignment. Assignment techniques. All or nothing assignment.

Brief review of multipath assignment, capacity restraint assignment and diversion curves.

UNIT-IV

Modal Split: General considerations for modal split. Factors affecting modal split. Brief introduction to various methods of modal split.

Evaluation: Need for evaluation. Several plans to be formulated. Testing. Considerations in evaluation. Economic evaluation, basic principles, brief introduction to various methods of economic evaluation, comparison.

Mass Rapid Transit Systems: Problems of Urban Transport. Introduction to MRTS. Requirements of MRTS. Types of MRTS. MRTS in India

**Recommended Books:**

1. Traffic Engg. And Transport Planning by L.R.Kadiyali, Khanna Publishers, Delhi.
2. Highway Engg by S.K. Khanna & C.E.G. Justo, New Chand Bros., Roorkee.
3. Introduction to Transport Planning by Bruton, M.J., Hutchinson Technical Education, London.
4. Principles of Transportation Engineering by Chakroborty & Das, Prentice Hall

**MCH- 203A: Road Transport Regulations & Administration**

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| L |  T P/D | Credits | Max Marks |  :100 |
| 3 | 0 | 3 | Major Test  |  :60 Marks |
|  |  |  | Minor Test :40Marks Duration :3Hours |
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UNIT I

Introduction to Traffic regulations and control - Regulation on vehicles, drivers and traffic flow, Traffic control devices – Types & objectives of markings, signs, signals and islands, delineators.

Role of M.V. Department in existing road transport scenario in India

UNIT II

Transportation systems – sustainable transport - mobility, accessibility – safety, environment - revenue generation.

M.V. Act and CMV Rules – Implementation issues thereof, Issues in road enforcement, control of traffic, signage.

UNIT III

Transportation planning process and demand forecasting, road safety issues, coordination with other agencies, claims & compensation under MV Act.

Issues in insurance of vehicles, licensing of drivers, taxation of vehicles and passengers, permits under MV Act.

UNIT IV

Inspection/ testing and certification of vehicles. Bus body code & Bus body accreditation system.

Developing customer orientation in M.V. Department functions, RFID based Driving Skill Evaluation system (IDTS)

**REFERENCE BOOKS:**

1. Principles of Transportation Engineering by Chakraborty & Das, Prentice Hall, India.
2. Highway Engg by S.K.Khanna & C.E.G. Justo, New Chand Bros., Roorkee.
3. Principles and Practice of Highway Engg. By L.R.Kadiyali , Khanna Publishers , Delhi.
4. MORTH Specifications for Road and Bridge Works, IRC Publication

**MCH- 205A: Design and Construction of Bridges and Flyovers**

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| L |  T P/D | Credits | Max Marks |  :100 |
| 3 |  0 | 3 |  Major Test  |  :60 Marks |
|  |  |  |  Minor Test :40MarksDuration : 3Hours |
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UNIT I

Introduction–classification and components of bridges– layout and planning– Structural forms of bridge decks – grillage analysis of slab decks, beam and slab decks, and cellular decks. Standard specifications for bridges – IRC loadings for road bridges – standards for railway bridges.

Loads on Bridge: Dead loads, live loads, dynamic effects of vehicles, longitudinal forces, centrifugal forces, wind loads, earth quake forces, stream flow pressure, load combinations, design examples

UNIT II

Design of T beam bridges – balanced cantilever bridges – rigid frame bridges – Arch bridges – bow string girder bridges.

Design of Bridge Slabs: Longitudinally reinforced deck slabs, transversely reinforced bridge slabs

UNIT III

Design of plate girder bridges – steel trussed bridges – Introduction to long span bridges: cable stayed bridges and suspension bridges –instability.

Principles of Planning of Elevated Rail Transit System, grade separation structures, pedestrian crossing and sub- ways.

Forces on piers and abutments – Design of piers and abutments – types of wing walls – types of bearings – design of bearings.

UNIT IV

Design of Prestressed Concrete Bridges: Design code, design examples. Segmental Box bridges - precast sections, criteria, design examples

Sub-Structure Design: Foundation investigation, bearings, bridge pier design, and abutment design.

Examples.

**REFERENCE BOOKS:**

1. Raina, R.K, 'Principles of Design of RCC Bridges, Tata McGraw Hill,1999.
2. N. Krishna Raju, Design of bridges, Oxford & IBH publishing Co. Ltd., New Delhi.
3. D.Johnson Victor, Essentials of bridge engineering, Oxford & IBH publishing Co. Ltd., New Delhi.
4. Jaikrishna and O.P Jain, Plain and reinforced concrete-vol.II, Nem Chnand & Bros,Roorkee.
5. IRC: 5 -1970, Standard specifications and code of practice for road bridges, Sections I to V.
6. Indian railway standard code of practice for the design of steel or wrought iron bridge carrying Rail, road or pedestrian traffic, Govt. of India, Ministry of Railways, 1962.
7. Conrad P. Heins and Richard A. Lawrie, `Design of Modern Concrete Highway Bridges,

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| **MTOE-201A** | **Business Analytics** |  |
| **Lecture** | **Tutorial** | **Practical** | **Credit** | **Major Test** | **Minor Test** | **Total** | **Time** |
| **3** | **0** | **0** | **3** | **60** | **40** | **100** | **3 Hrs.** |
| **Program Objective (PO)** | The main objective of this course is to give the student a comprehensive understanding of business analytics methods. |
| **Course Outcomes (CO)** |  |
| **CO1** | *Able to have knowledge of various business analysis techniques.* |
| **CO2** | *Learn the requirement specification and transforming the requirement into different models.* |
| **CO3** | *Learn the requirement representation and managing requirement assests.* |
| **CO4** | *Learn the Recent Trends in Embedded and collaborative business* |  |

**Unit 1**

Business Analysis: Overview of Business Analysis, Overview of Requirements, Role of the Business Analyst.

Stakeholders: the project team, management, and the front line, Handling, Stakeholder Conflicts.

Life Cycles: Systems Development Life Cycles, Project Life Cycles, Product Life Cycles, Requirement Life Cycles.

**Unit 2**

Forming Requirements: Overview of Requirements Attributes of Good Requirements, Types of Requirements, Requirement Sources, Gathering Requirements from Stakeholders, Common Requirements Documents.

Transforming Requirements: Stakeholder Needs Analysis, Decomposition Analysis, Additive/Subtractive Analysis, Gap Analysis, Notations (UML & BPMN), Flowcharts, Swim Lane Flowcharts, Entity-Relationship Diagrams, State-Transition Diagrams, Data Flow Diagrams, Use Case Modeling, Business Process Modeling

**Unit 3**

Finalizing Requirements: Presenting Requirements, Socializing Requirements and Gaining Acceptance, Prioritizing Requirements.

Managing Requirements Assets: Change Control, Requirements Tools

**Unit 4**

Recent Trends in: Embedded and collaborative business intelligence, Visual data recovery, Data Storytelling and Data Journalism.

**References:**

1. Business Analysis by James Cadle et al.

2. Project Management: The Managerial Process by Erik Larson and, Clifford Gray

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| **MTOE-203A** | **Industrial Safety**  |  |
| **Lecture** | **Tutorial** | **Practical** | **Credit** | **Major Test** | **Minor Test** | **Total** | **Time** |
| **3** | **0** | **0** | **3** | **60** | **40** | **100** | **3 Hrs.** |
| **Program Objective (PO)** | *To enable students to aware about the industrial safety.* |
| **Course Outcomes (CO)** |  |
| **CO1** | *Understand the industrial safety.* |
| **CO2** | *Analyze fundamental of maintenance engineering.* |
| **CO3** | *Understand the wear and corrosion and fault tracing.* |
| **CO4** | *Understanding that when to do periodic inceptions and apply the preventing maintenance.*  |  |

**Unit-1**

Industrial safety: Accident, causes, types, results and control, mechanical and electrical hazards, types, causes and preventive steps/procedure, describe salient points of factories act 1948 for health and safety, washrooms, drinking water layouts, light, cleanliness, fire, guarding, pressure vessels, etc, Safety color codes. Fire prevention and firefighting, equipment and methods.

Fundamentals of maintenance engineering: Definition and aim of maintenance engineering, Primary and secondary functions and responsibility of maintenance department, Types of maintenance, Types and applications of tools used for maintenance, Maintenance cost & its relation with replacement economy, Service life of equipment.

**Unit-2**

Wear and Corrosion and their prevention: Wear- types, causes, effects, wear reduction methods, lubricants-types and applications, Lubrication methods, general sketch, working and applications, i. Screw down grease cup, ii. Pressure grease gun, iii. Splash lubrication, iv. Gravity lubrication, v. Wick feed lubrication vi. Side feed lubrication, vii. Ring lubrication, Definition, principle and factors affecting the corrosion. Types of corrosion, corrosion prevention methods.

**Unit-3**

Fault tracing: Fault tracing-concept and importance, decision treeconcept, need and applications, sequence of fault finding activities, show as decision tree, draw decision tree for problems in machine tools, hydraulic, pneumatic,automotive, thermal and electrical equipment’s like, I. Any one machine tool, ii. Pump iii. Air compressor, iv. Internal combustion engine, v. Boiler, vi. Electrical motors, Types of faults in machine tools and their general causes.

**Unit-4**

Periodic and preventive maintenance: Periodic inspection-concept and need, degreasing, cleaning and repairing schemes, overhauling of mechanical components, overhauling of electrical motor, common troubles and remedies of electric motor, repair complexities and its use, definition, need, steps and advantages of preventive maintenance. Steps/procedure for periodic and preventive maintenance of: I. Machine tools, ii. Pumps, iii. Air compressors, iv. Diesel generating (DG) sets Program and schedule of preventive maintenance of mechanical and electrical equipment, advantages of preventive maintenance. Repair cycle concept and importance

**Reference:**

1. Maintenance Engineering Handbook, Higgins & Morrow, Da Information Services.
2. Maintenance Engineering, H. P. Garg, S. Chand and Company.
3. Pump-hydraulic Compressors, Audels, Mcgrew Hill Publication.
4. Foundation Engineering Handbook, Winterkorn, Hans, Chapman & Hall London.

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| **MTOE-205A** | **Operations Research**  |  |
| **Lecture** | **Tutorial** | **Practical** | **Credit** | **Major Test** | **Minor Test** | **Total** | **Time** |
| **3** | **0** | **0** | **3** | **60** | **40** | **100** | **3 Hrs.** |
| **Program Objective (PO)** | To enable students to aware about the dynamic programming to solve problems of discreet and continuous variables and model the real world problem and simulate it. |
| **Course Outcomes (CO)** |  |
| **CO1** | *Students should able to apply the dynamic programming to solve problems of discreet and continuous variables.* |
| **CO2** | *Students should able to apply the concept of non-linear programming* |
| **CO3** | *Students should able to carry out sensitivity analysis* |
| **CO4** | *Student should able to model the real world problem and simulate it.* |  |

**Unit -1**

Optimization Techniques, Model Formulation, models, General L.R Formulation, Simplex Techniques, Sensitivity Analysis, Inventory Control Models

**Unit -2**

Formulation of a LPP - Graphical solution revised simplex method - duality theory - dual simplex method - sensitivity analysis - parametric programming

Nonlinear programming problem - Kuhn-Tucker conditions min cost flow problem - max flow problem - CPM/PERT

**Unit- 3**

Scheduling and sequencing - single server and multiple server models - deterministic inventory models - Probabilistic inventory control models - Geometric Programming.

**Unit -4**

Competitive Models, Single and Multi-channel Problems, Sequencing Models, Dynamic Programming, Flow in Networks, Elementary Graph Theory, Game Theory Simulation

**References:**

1. H.A. Taha, Operations Research, An Introduction, PHI, 2008
2. H.M. Wagner, Principles of Operations Research, PHI, Delhi, 1982.
3. J.C. Pant, Introduction to Optimisation: Operations Research, Jain Brothers, Delhi, 2008
4. Hitler Libermann Operations Research: McGraw Hill Pub. 2009
5. Pannerselvam, Operations Research: Prentice Hall of India 2010
6. Harvey M Wagner, Principles of Operations Research: Prentice Hall of India 2010

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| **MTOE-207A** | **Cost Management of Engineering Projects**  |  |
| **Lecture** | **Tutorial** | **Practical** | **Credit** | **Major Test** | **Minor Test** | **Total** | **Time** |
| **3** | **0** | **0** | **3** | **60** | **40** | **100** | **3 Hrs.** |
| **Program Objective (PO)** | *To enable students to make aware about the cost management for the engineering project and apply cost models the real world projects.* |
| **Course Outcomes (CO)** |  |
| **CO1** | *Students should able to learn the strategic cost management process.* |
| **CO2** | *Students should able to types of project and project team types* |
| **CO3** | *Students should able to carry out Cost Behavior and Profit Planning analysis.* |
| **CO4** | *Student should able to learn the quantitative techniques for cost management.* |  |

**Unit-1**

Introduction and Overview of the Strategic Cost Management Process Cost concepts in decision-making; relevant cost, Differential cost, Incremental cost and Opportunity cost.Objectives of a Costing System; Inventory valuation; Creation of a Database for operational control; Provision of data for Decision-Making.

**Unit-2**

Project: meaning, Different types, why to manage, cost overruns centres, various stages of project execution: conception to commissioning. Project execution as conglomeration of technical and nontechnical activities.Detailed Engineering activities. Pre project execution main clearances and documents Project team: Role of each member. Importance Project site: Data required with significance. Project contracts.Types and contents. Project execution Project cost control. Bar charts and Network diagram. Project commissioning: mechanical and process

**Unit-3**

Cost Behavior and Profit Planning Marginal Costing; Distinction between Marginal Costing and Absorption Costing; Break-even Analysis, Cost-Volume-Profit Analysis. Various decision-making problems.Standard Costing and Variance Analysis. Pricing strategies: Pareto Analysis. Target costing, Life Cycle Costing. Costing of service sector.Just-in-time approach, Material Requirement Planning, Enterprise Resource Planning, Total Quality Management and Theory of constraints.Activity-Based Cost Management, Bench Marking; Balanced Score Card and Value-Chain Analysis.Budgetary Control; Flexible Budgets; Performance budgets; Zero-based budgets.Measurement of Divisional profitability pricing decisions including transfer pricing.

**Unit-4**

Quantitative techniques for cost management, Linear Programming, PERT/CPM, Transportation problems, Assignment problems, Simulation, Learning Curve Theory.

**References:**

1. Cost Accounting A Managerial Emphasis, Prentice Hall of India, New Delhi
2. Charles T. Horngren and George Foster, Advanced Management Accounting
3. Robert S Kaplan Anthony A. Alkinson, Management & Cost Accounting
4. Ashish K. Bhattacharya, Principles & Practices of Cost Accounting A. H. Wheeler publisher
5. N.D. Vohra, Quantitative Techniques in Management, Tata McGraw Hill Book Co. Ltd.

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| **MTOE-209A** | **Composite Materials**  |  |
| **Lecture** | **Tutorial** | **Practical** | **Credit** | **Major Test** | **Minor Test** | **Total** | **Time** |
| **3** | **0** | **0** | **3** | **60** | **40** | **100** | **3 Hrs.** |
| **Program Objective (PO)** | *To enable students to aware about the composite materials and their properties.* |
| **Course Outcomes (CO)** |  |
| **CO1** | *Students should able to learn the Classification and characteristics of Composite materials.* |
| **CO2** | *Students should able reinforcements Composite materials.* |
| **CO3** | *Students should able to carry out the preparation of compounds.* |
| **CO4** | *Student should able to do the analysis of the composite materials.* |  |

**UNIT–1**:

INTRODUCTION: Definition – Classification and characteristics of Composite materials. Advantages and application of composites.Functional requirements of reinforcement and matrix.Effect of reinforcement (size, shape, distribution, volume fraction) on overall composite performance.

REINFORCEMENTS: Preparation-layup, curing, properties and applications of glass fibers, carbon fibers, Kevlar fibers and Boron fibers. Properties and applications of whiskers, particle reinforcements. Mechanical Behavior of composites: Rule of mixtures, Inverse rule of mixtures. Iso-strain and Iso-stress conditions.

**UNIT – 2**

Manufacturing of Metal Matrix Composites: Casting – Solid State diffusion technique, Cladding – Hot isostaticpressing.Properties and applications. Manufacturing of Ceramic Matrix Composites: Liquid Metal Infiltration – Liquid phase sintering. Manufacturing of Carbon – Carbon composites: Knitting, Braiding, Weaving. Properties and applications.

**UNIT–3**

Manufacturing of Polymer Matrix Composites: Preparation of Moulding compounds and prepregs – hand layup method – Autoclave method – Filament winding method – Compression moulding – Reaction injection moulding. Properties and applications.

**UNIT – 4**

Strength: Laminar Failure Criteria-strength ratio, maximum stress criteria, maximum strain criteria, interacting failure criteria, hygrothermal failure. Laminate first play failure-insight strength; Laminate strength-ply discount truncated maximum strain criterion; strength design using caplet plots; stress concentrations.

**TEXT BOOKS:**

1. Material Science and Technology – Vol 13 – Composites by R.W.Cahn – VCH, West Germany.
2. Materials Science and Engineering, An introduction. WD Callister, Jr., Adapted by R.

3. Balasubramaniam, John Wiley & Sons, NY, Indian edition, 2007.

**References:**

1. Hand Book of Composite Materials-ed-Lubin.
2. Composite Materials – K.K.Chawla.
3. Composite Materials Science and Applications – Deborah D.L. Chung.
4. Composite Materials Design and Applications – Danial Gay, Suong V. Hoa, and Stephen W. Tasi.

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| **MTOE-211A** | **Waste to Energy** |  |
| **Lecture** | **Tutorial** | **Practical** | **Credit** | **Major Test** | **Minor Test** | **Total** | **Time** |
| **3** | **0** | **0** | **3** | **60** | **40** | **100** | **3 Hrs.** |
| **Program Objective (PO)** | *To enable students to aware about the generation of energy from the waste.* |
| **Course Outcomes (CO)** |  |
| **CO1** | *Students should able to learn the Classification of waste as a fuel.* |
| **CO2** | *Students should able to learn the Manufacture of charcoal.* |
| **CO3** | *Students should able to carry out the designing of gasifiers and biomass stoves.* |
| **CO4** | *Student should able to learn the Biogas plant technology.* |  |

**Unit-1**

Introduction to Energy from Waste: Classification of waste as fuel – Agro based, Forest residue, Industrial waste - MSW – Conversion devices – Incinerators, gasifiers, digestors

Biomass Pyrolysis: Pyrolysis – Types, slow fast – Manufacture of charcoal – Methods - Yields and application – Manufacture of pyrolytic oils and gases, yields and applications.

**Unit-2**

Biomass Gasification: Gasifiers – Fixed bed system – Downdraft and updraft gasifiers – Fluidized bed gasifiers – Design, construction and operation – Gasifier burner arrangement for thermal heating – Gasifier engine arrangement and electrical power – Equilibrium and kinetic consideration in gasifier operation.

**Unit-3**

 Biomass Combustion: Biomass stoves – Improved chullahs, types, some exotic designs, Fixed bed combustors, Types, inclined grate combustors, Fluidized bed combustors, Design, construction and operation - Operation of all the above biomass combustors.

**Unit-4**

Biogas: Properties of biogas (Calorific value and composition) - Biogas plant technology and status - Bio energy system - Design and constructional features - Biomass resources and their classification - Biomass conversion processes - Thermo chemical conversion - Direct combustion - biomass gasification - pyrolysis and liquefaction - biochemical conversion - anaerobic digestion - Types of biogas Plants – Applications - Alcohol production from biomass - Bio diesel production - Urban waste to energy conversion - Biomass energy programme in India.

**References:**

1. Non Conventional Energy, Desai, Ashok V., Wiley Eastern Ltd., 1990.
2. Biogas Technology - A Practical Hand Book - Khandelwal, K. C. and Mahdi, S. S., Vol. I & II, Tata McGraw Hill Publishing Co. Ltd., 1983.
3. Food, Feed and Fuel from Biomass, Challal, D. S., IBH Publishing Co. Pvt. Ltd., 1991.
4. Biomass Conversion and Technology, C. Y. WereKo-Brobby and E. B. Hagan, John Wiley & Sons, 1996.

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| **MTAD-101A** | **English For Research Paper Writing**  |  |
| **Lecture** | **Tutorial** | **Practical** | **Credit** | **Major Test** | **Minor Test** | **Total** | **Time** |
| **2** | **0** | **0** | **0** | **-** | **100** | **100** | **3 Hrs.** |
| **Program Objective (PO)** | *Student will able to understand the basic rules of research paper writing.* |
| **Course Outcomes (CO)** |  |
| **CO1** | *Understand that how to improve your writing skills and level of readability*  |
| **CO2** | *Learn about what to write in each section*  |
| **CO3** | *Understand the skills needed when writing a Title*  |
| **CO4** | *Ensure the good quality of paper at very first-time submission* |  |

**Unit 1**

Planning and Preparation, Word Order, Breaking up long sentences, Structuring Paragraphs and Sentences, Being Concise and Removing Redundancy, Avoiding Ambiguity and Vagueness

**Unit 2**

Clarifying Who Did What, Highlighting Your Findings, Hedging and Criticizing, Paraphrasing and Plagiarism, Sections of a Paper, Abstracts. Introduction

**Unit 3**

Review of the Literature, Methods, Results, Discussion, Conclusions, the Final Check. key skills are needed when writing a Title, key skills are needed when writing an Abstract, key skills are needed when writing an Introduction, skills needed when writing a Review of the Literature,

**Unit4**

Skills are needed when writing the Methods, skills needed when writing the Results, skills are needed when writing the Discussion, skills are needed when writing the Conclusions Useful phrases, how to ensure paper is as good as it could possibly be the first- time submission.

**References:**

1. Goldbort R (2006) Writing for Science, Yale University Press (available on Google Books)
2. Day R (2006) How to Write and Publish a Scientific Paper, Cambridge University Press
3. Highman N (1998), Handbook of Writing for the Mathematical Sciences, SIAM. Highman’sbook.
4. Adrian Wallwork, English for Writing Research Papers, Springer New York Dordrecht

Heidelberg London, 2011

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| **MTAD-103A** | **Disaster Management**  |  |
| **Lecture** | **Tutorial** | **Practical** | **Credit** | **Major Test** | **Minor Test** | **Total** | **Time** |
| **2** | **0** | **0** | **0** | **-** | **100** | **100** | **3 Hrs.** |
| **Program Objective (PO)** | *Develop an understanding of disaster risk reduction and management* |
| **Course Outcomes (CO)** |  |
| **CO1** | *Learn to demonstrate a critical understanding of key concepts in disaster risk reduction and humanitarian response.*  |
| **CO2** | *Critically evaluate disaster risk reduction and humanitarian response policy and practice from multiple perspectives.*  |
| **CO3** | *Develop an understanding of standards of humanitarian response and practical relevance in specific types of disasters and conflict situations.*  |
| **CO4** | *critically understand the strengths and weaknesses of disaster management approaches, planning and programming in different countries, particularly their home country or the countries they work in* |  |

**Unit 1**

Disaster: Definition, Factors and Significance; Difference between Hazard and Disaster; Natural and Manmade Disasters: Difference, Nature, Types and Magnitude.

**Unit 2**

Repercussions of Disasters and Hazards: Economic Damage, Loss of Human and Animal Life, Destruction of Ecosystem. Natural Disasters: Earthquakes, Volcanisms, Cyclones, Tsunamis, Floods, Droughts And Famines, Landslides And Avalanches, Man-made disaster: Nuclear Reactor Meltdown, Industrial Accidents, Oil Slicks And Spills, Outbreaks Of Disease And Epidemics, War And Conflicts.

**Unit 3**

Study Of Seismic Zones; Areas Prone To Floods And Droughts, Landslides And Avalanches; Areas Prone To Cyclonic And Coastal Hazards With Special Reference To Tsunami; Post-Disaster Diseases And Epidemics Preparedness: Monitoring Of Phenomena Triggering A Disaster Or Hazard; Evaluation Of Risk: Application Of Remote Sensing, Data From Meteorological And Other Agencies, Media Reports: Governmental And Community Preparedness.

**Unit 4**

Disaster Risk: Concept and Elements, Disaster Risk Reduction, Global and National Disaster Risk Situation. Techniques of Risk Assessment, Global Co-Operation in Risk Assessment and Warning, People’s Participation in Risk Assessment.Strategies for Survival.Meaning, Concept and Strategies of Disaster Mitigation, Emerging Trends in Mitigation.Structural Mitigation and Non-Structural Mitigation, Programs Of Disaster Mitigation in India.

**References:**

1. R. Nishith, Singh AK, “Disaster Management in India: Perspectives, issues and strategies “’New Royal book Company.
2. Sahni, PardeepEt.Al. (Eds.),” Disaster Mitigation Experiences And Reflections”, Prentice Hall Of India, New Delhi.
3. Goel S. L., Disaster Administration And Management Text And Case Studies”,Deep&Deep Publication Pvt. Ltd., New Delhi.

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| **MTAD-105A** | **Sanskrit for Technical Knowledge**  |  |
| **Lecture** | **Tutorial** | **Practical** | **Credit** | **Major Test** | **Minor Test** | **Total** | **Time** |
| **2** | **0** | **0** | **0** | **-** | **100** | **100** | **3 Hrs.** |
| **Program Objective (PO)** | *Students will be able to Understanding basic Sanskrit language and Ancient Sanskrit literature about science & technology can be understood and Being a logical language will help to develop logic in students*  |
| **Course Outcomes (CO)** |  |
| **CO1** | *To get a working knowledge in illustrious Sanskrit, the scientific language in the world*  |
| **CO2** | *Learning of Sanskrit to improve brain functioning*  |
| **CO3** | *Learning of Sanskrit to develop the logic in mathematics, science & other subjects enhancing the memory power*  |
| **CO4** | *The engineering scholars equipped with Sanskrit will be able to explore the huge knowledge from ancient literature*  |  |

**Unit –1**

Alphabets in Sanskrit, Past/Present/Future Tense, Simple Sentences.

**Unit – 2**

Order, Introduction of roots,Technical information about Sanskrit Literature

**Unit –3**

Technical concepts of Engineering: Electrical, Mechanical

**Unit –4**

Technical concepts of Engineering: Architecture, Mathematics

***References***

1. “Abhyaspustakam” – Dr.Vishwas, Samskrita-Bharti Publication, New Delhi
2. “Teach Yourself Sanskrit” PrathamaDeeksha-VempatiKutumbshastri, Rashtriya Sanskrit Sansthanam, New Delhi Publication
3. “India’s Glorious Scientific Tradition” Suresh Soni, Ocean books (P) Ltd., New Delhi.

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| **MTAD-107A** | **Value Education** |  |
| **Lecture** | **Tutorial** | **Practical** | **Credit** | **Major Test** | **Minor Test** | **Total** | **Time** |
| **2** | **0** | **0** | **0** | **-** | **100** | **100** | **3 Hrs.** |
| **Program Objective (PO)** | *Understand value of education and self- development, Imbibe good values in students and Let the should know about the importance of character*  |
| **Course Outcomes (CO)** |  |
| **CO1** | *Knowledge of self-development*  |
| **CO2** | *Learn the importance of Human values*  |
| **CO3** | *Developing the overall personality*  |
| **CO4** | *Know about the importance of character* |  |

**Unit 1**

Values and self-development –Social values and individual attitudes.Work ethics, Indian vision of humanism.Moral and non- moral valuation.Standards and principles.Value judgements.

**Unit 2**

Importance of cultivation of values.Sense of duty.Devotion, Self-reliance.Confidence, Concentration.Truthfulness, Cleanliness.Honesty, Humanity.Power of faith, National Unity.Patriotism.Love for nature,Discipline

**Unit 3**

Personality and Behavior Development - Soul and Scientific attitude.Positive Thinking.Integrity and discipline.Punctuality, Love and Kindness. Avoid fault Thinking. Free from anger, Dignity of labour. Universal brotherhood and religious tolerance.True friendship. Happiness Vs suffering, love for truth. Aware of self-destructive habits.Association and Cooperation. Doing best for saving nature

**Unit 4**

Character and Competence –Holy books vs Blind faith.Self-management and Good health.Science of reincarnation. Equality, Nonviolence,Humility, Role of Women. All religions and same message. Mind your Mind, Self-control. Honesty, Studying effectively

***References***

1.Chakroborty, S.K. “Values and Ethics for organizations Theory and practice”, Oxford University Press, New Delhi

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| **MTAD-102A** | **Constitution of India**  |  |
| **Lecture** | **Tutorial** | **Practical** | **Credit** | **Major Test** | **Minor Test** | **Total** | **Time** |
| **2** | **0** | **0** | **0** | **-** | **100** | **100** | **3 Hrs.** |
| **Program Objective (PO)** | *Understand the premises informing the twin themes of liberty and freedom from a civil rights perspective and to address the growth of Indian opinion regarding modern Indian intellectuals’ constitutional role and entitlement to civil and economic rights as well as the emergence of nationhood in the early years of Indian nationalism.*  |
| **Course Outcomes (CO)** |  |
| **CO1** | *Discuss the growth of the demand for civil rights in India for the bulk of Indians before the arrival of Gandhi in Indian politics.*  |
| **CO2** | *Discuss the intellectual origins of the framework of argument that informed the conceptualization of social reforms leading to revolution in India.*  |
| **CO3** | *Discuss the circumstances surrounding the foundation of the Congress Socialist Party [CSP] under the leadership of Jawaharlal Nehru and the eventual failure of the proposal of direct elections through adult suffrage in the Indian Constitution.*  |
| **CO4** | *Discuss the passage of the Hindu Code Bill of 1956.*  |  |

**Unit I**

History of Making of the Indian Constitution: History, Drafting Committee, (Composition & Working) Philosophy of the Indian Constitution: Preamble, Salient Features

**Unit 2**

Contours of Constitutional Rights & Duties: Fundamental Rights , Right to Equality , Right to Freedom , Right against Exploitation , Right to Freedom of Religion, Cultural and Educational Rights , Right to Constitutional Remedies , Directive Principles of State Policy , Fundamental Duties.

Organs of Governance: Parliament, Composition, Qualifications and Disqualifications, Powers and Functions, Executive , President, Governor , Council of Ministers, Judiciary, Appointment and Transfer of Judges, Qualifications. Powers and Functions

**Unit 3**

Local Administration: District’s Administration head: Role and Importance, Municipalities: Introduction, Mayor and role of Elected Representative CEO of Municipal Corporation, Panchayati raj: Introduction, PRI: ZilaPanchayat, Elected officials and their roles, CEO ZilaPanchayat: Position and role. Block level: Organizational Hierarchy (Different departments), Village level: Role of Elected and Appointed officials, Importance of grass root democracy

**Unit 4**

Election Commission: Election Commission: Role and Functioning. Chief Election Commissioner and Election Commissioners. State Election Commission: Role and Functioning. Institute and Bodies for the welfare of SC/ST/OBC and women.

**References**

1. The Constitution of India, 1950 (Bare Act), Government Publication.
2. Dr. S. N. Busi, Dr. B. R. Ambedkar framing of Indian Constitution, 1st Edition, 2015.
3. M. P. Jain, Indian Constitution Law, 7th Edn., Lexis Nexis, 2014.
4. D.D. Basu, Introduction to the Constitution of India, Lexis Nexis, 2015.

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| **MTAD-104A** | **Pedagogy Studies** |  |
| **Lecture** | **Tutorial** | **Practical** | **Credit** | **Major Test** | **Minor Test** | **Total** | **Time** |
| **2** | **0** | **0** | **0** | **-** | **100** | **100** | **3 Hrs.** |
| **Program Objective (PO)** | *Review existing evidence on the review topic to inform programme design and policy making undertaken by the DFID, other agencies and researchers and Identify critical evidence gaps to guide the development*. |
| **Course Outcomes (CO)** |  |
| **CO1** | *What pedagogical practices are being used by teachers in formal and informal classrooms in developing countries?*  |
| **CO2** | *What is the evidence on the effectiveness of these pedagogical practices, in what conditions, and with what population of learners?*  |
| **CO3** | *How can teacher education (curriculum and practicum) and the school curriculum and guidance materials best support effective pedagogy?*  |
| **CO4** | *What is the importance of identifying research gaps?* |  |

**Unit 1**

Introduction and Methodology: Aims and rationale, Policy background, Conceptual framework and terminology , Theories of learning, Curriculum, Teacher education., Conceptual framework, Research questions. Overview of methodology and Searching. Thematic overview: Pedagogical practices are being used by teachers in formal and informal classrooms in developing countries. , Curriculum, Teacher education.

**Unit 2**

Evidence on the effectiveness of pedagogical practices, Methodology for the in depth stage: quality assessment of included studies. How can teacher education (curriculum and practicum) and the school curriculum and guidance materials best support effective pedagogy? Theory of change.Strength and nature of the body of evidence for effective pedagogical practices.Pedagogic theory and pedagogical approaches.Teachers’ attitudes and beliefs and Pedagogic strategies.

**Unit 3**

Professional development: alignment with classroom practices and follow-up support, Peer support from the head teacher and the community. Curriculum and assessment, Barriers to learning: limited resources and large class sizes,

**Unit 4**

Research gaps and future directions: Research design, Contexts , Pedagogy, Teacher education Curriculum and assessment, Dissemination and research impact.

**References**

1. Ackers J, Hardman F (2001) Classroom interaction in Kenyan primary schools, Compare, 31 (2): 245-261.
2. Agrawal M (2004) Curricular reform in schools: The importance of evaluation, Journal of Curriculum Studies, 36 (3): 361-379.
3. Akyeampong K (2003) Teacher training in Ghana - does it count? Multi-site teacher education research project (MUSTER) country report 1. London: DFID.
4. Akyeampong K, Lussier K, Pryor J, Westbrook J (2013) Improving teaching and learning of basic maths and reading in Africa: Does teacher preparation count? International Journal Educational Development, 33 (3): 272–282.
5. Alexander RJ (2001) Culture and pedagogy: International comparisons in primary education. Oxford and Boston: Blackwell.
6. Chavan M (2003) Read India: A mass scale, rapid, ‘learning to read’ campaign.

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| **MTAD-106A** | **Stress Management by Yoga** |  |
| **Lecture** | **Tutorial** | **Practical** | **Credit** | **Major Test** | **Minor Test** | **Total** | **Time** |
| **2** | **0** | **0** | **0** | **-** | **100** | **100** | **3 Hrs.** |
| **Program Objective (PO)** | To achieve overall health of body and mind and to overcome stress |
| **Course Outcomes (CO)** |  |
| **CO1** | *Develop healthy mind in a healthy body thus improving social health.*  |
| **CO2** | *Improve efficiency*  |
| **CO3** |  *Learn the Yogasan* |
| **CO4** | *Learn the pranayama* |  |

**Unit – 1**

Definitions of Eight parts of yog (Ashtanga).

**Unit- 2**

Yam and Niyam, Do`s and Don’t’s in life; Ahinsa, satya, astheya, bramhacharya and aparigraha; Shaucha, santosh, tapa, swadhyay, ishwarpranidhan.

**Unit- 3**

Asan and Pranayam, Various yog poses and their benefits for mind & body,

**Unit- 4**

Regularization of breathing techniques and its effects-Types of pranayam.

**References**

1. ‘Yogic Asanas for Group Tarining-Part-I” :Janardan Swami YogabhyasiMandal, Nagpur
2. “Rajayoga or conquering the Internal Nature” by Swami Vivekananda, AdvaitaAshrama (Publication Department), Kolkata

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| **MTAD-108A** | **Personality Development through Life Enlightenment Skills** |  |
| **Lecture** | **Tutorial** | **Practical** | **Credit** | **Major Test** | **Minor Test** | **Total** | **Time** |
| **2** | **0** | **0** | **0** | **-** | **100** | **100** | **3 Hrs.** |
| **Program Objective (PO)** | To learn to achieve the highest goal happily To become a person with stable mind, pleasing personality and determination To awaken wisdom in students  |
| **Course Outcomes (CO)** |  |
| **CO1** | *Students become aware about leadership.* |
| **CO2** | *Students will learn how to perform his/her duties in day to day work.* |
| **CO3** | *Understand the team building and conflict* |
| **CO4** | *Student will learn how to become role model for the society.* |  |

**Unit – 1**

Neetisatakam-Holistic development of personality: Verses: 19, 20, 21, 22 (wisdom); Verses: 29, 31, 32 (pride & heroism); Verses: 26, 28, 63, 65 (virtue); Verses: 52, 53, 59 (don’s); Verses: 71, 73, 75, 78 (do’s).

**Unit – 2**

Approach to day to day work and duties; ShrimadBhagwadGeeta: Chapter-2: Verses: 41, 47, 48; Chapter-3: Verses: 13, 21, 27, 35; Chapter-6: Verses: 5, 13, 17, 23, 35; Chapter-18: Verses: 45, 46, 48.

**Unit - 3**

Statements of basic knowledge; ShrimadBhagwadGeeta: Chapter-2: Verses: 56, 62, 68; Chapter-12: Verses: 13, 14, 15, 16, 17, 18.

**Unit – 4**

Personality of Role model; ShrimadBhagwadGeeta: Chapter-2: Verses: 17; Chapter-3: Verses: 36, 37, 42: Chapter-4: Verses: 18, 38, 39; Chapter-18: Verses: 37, 38, 63.

***References:***

1. Srimad Bhagavad Gita, Swami SwarupanandaAdvaita Ashram (Publication Department), Kolkata.
2. Bhartrihari’s Three Satakam (Niti-sringar-vairagya), P. Gopinath, Rashtriya Sanskrit Sansthanam, New Delhi.

**Dissertation Phase – I and Dissertation Phase - II**

**Teaching Scheme**

Lab work : 18 and 32 hrs/week for Dissertation Phase- I (MCH-207A)and Phase- II (MCH-202A) respectively

**Course Outcomes:**

At the end of this course, students will be able to

* 1. Ability to synthesize knowledge and skills previously gained and applied to an in-depth study and execution of new technical problem.
	2. Capable to select from different methodologies, methods and forms of analysis to produce a suitable research design, and justify their design.
	3. Ability to present the findings of their technical solution in a written report. Presenting the work in International/ National conference or reputed journals.

**Syllabus Contents:**

The dissertation / project topic should be selected / chosen to ensure the satisfaction of the urgent need to establish a direct link between education, national development and productivity and thus reduce the gap between the world of work and the world of study. The dissertation should have the following

1. Relevance to social needs of society
* Relevance to value addition to existing facilities in the
* Relevance to industry need
1. Problems of national importance
2. Research and development in various domain
3. The student should complete the following:
* Literature survey Problem

Definition Motivation for study and Objectives

* Preliminary design / feasibility / modular approaches
* Implementation and Verification

5. Report and presentation

The dissertation phase- II is based on a report prepared by the students on dissertation allotted to them. It may be based on:

Experimental verification / Proof of concept.

Design, fabrication, testing of Communication System.

The viva-voce examination will be based on the above report and work.

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**Guidelines for Dissertation Phase – I and Phase-II**

As per the AICTE directives, the dissertation is a yearlong activity, to be carried out and evaluated in two phases i.e. Phase – I: July to December and Phase – II: January to June.

The dissertation may be carried out preferably in-house i.e. department’s laboratories and centers OR in industry allotted through department’s T & P coordinator.

After multiple interactions with guide and based on comprehensive literature survey, the student shall identify the domain and define dissertation objectives. The referred literature should preferably include IEEE/IET/IETE/Springer/Science Direct/ACM journals in the areas of Computing and Processing (Hardware and Software), Circuits-Devices and Systems, Communication-Networking and Security, Robotics and Control Systems, Signal Processing and Analysis and any other related domain. In case of Industry sponsored projects, the relevant application notes, while papers, product catalogues should be referred and reported.

Student is expected to detail out specifications, methodology, resources required, critical issues involved in design and implementation and phase wise work distribution, and submit the proposal within a month from the date of registration.

Phase – I deliverables: A document report comprising of summary of literature survey, detailed objectives, project specifications, paper and/or computer aided design, proof of concept/functionality, part results, A record of continuous progress.

Phase – I evaluation: A committee comprising of guides of respective specialization shall assess the progress/performance of the student based on report, presentation and Q & A. In case of unsatisfactory performance, committee may recommend repeating the Phase-I work.

During phase – II, student is expected to exert on design, development and testing of the proposed work as per the schedule. Accomplished results/contributions/innovations should be published in terms of research papers in reputed journals and reviewed focused conferences OR IP/Patents.

Phase – II deliverables: A dissertation report as per the specified format, developed system in the form of hardware and/or software, a record of continuous progress.

Phase – II evaluation: Guide along with appointed external examiner shall assess the progress/performance of the student based on report, presentation and Q & A. In case of unsatisfactory performance, committee may recommend for extension or repeating the work

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