List of New Course(s) Introduced

Department : *Mechanical Engineering*

Programme Name : *B.Tech.*

Academic Year : 2020-21

List of New Course(s) Introduced

Sr. No.	Course Code	Name of the Course
01.	ME05TPC07	Fluid & Turbo Machinery
02.	ME05TPE23	CAD/CAM
03.	ME06TOE13	Operations Research
04.	ME05PPE01	CAD / CAM Lab
05.	ME06PPC08	Manufacturing Science Lab

विभागाध्यक्ष/Head
यांत्रिकी अभियांत्रिकी विभाग/Mechanical Engg. Dept.
प्रौद्योगिकी संस्थान/Institute of Technology
गुरु घासीदास वि.वि./Guru Ghasidas V.V.
कोनी, बिलासपुर (छ.ग.)/Koni, Bilaspur (C.G.)

Minutes of Meeting

An online meeting of the Board of Studies of Mechanical Engineering was held on 10-08-2020 at 11:00 AM. The meeting was attended by the following members:

1.	Chairman, BOS	Prof. T. V. Arjunan Head, Dept. of Mechanical Engg.	Present
2.	Member, Academic Expert	Prof. Alok Satpathy Dept. of Mechanical Engg., NIT Rourkela	Present
3.	Member, BOS	Dr. Pankaj Kumar Gupta Assoc. Prof., Dept. of Mech. Engg.	Present
4.	Member, BOS	Mrs. Shweta Singh Asst. Prof., Dept. of Mech. Engg.	Present
5.	Member, Industry Expert	Mr. Vivek Singh, Executive Engineer, Damodar Valley Corporation Kodarma Thermal Power Station, Jharkhand	Absent

The Course Syllabi for 5th and 6th Semester of B.Tech IIIrd Year was discussed. With the consent of all the members The Course Syllabi for 5th and 6th Semester of B.Tech IIIrd Year was finalized the following were the salient features discussed in meeting:-

1 The following list of New courses were added in B.Tech:-

(a) Fluid & Turbo Machinery
(b) CAD-CAM
(c) CAD-CAM Lab
(d) Operation Research
(e) Manufacturing Science Lab

2 Industrial Engineering Course is Shiftedf from 5th Semester to 7th Semester

3 It was also decided to change the UNIT-wise breakup of syllabus to MODULE-wise breakup hence UNIT is replaced by MODULE all other remains as it is in the Syllabi

Prof. T. V. Arjunan
Chairman, BOS

Dr.Pankaj K. Gupta
Member, BOS

Mrs. Shweta Singh
Member, BOS

Prof. Alok Satapathy
Academic Expert

Mr. Vivek Singh
Industry Expert

विभागाध्यक्ष / Head
यांत्रिकी अभियांत्रिकी विभाग / Mechanical Engg. Dept.
प्रौद्योगिकी संस्थान / Institute of Technology
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कोनी, बिलासपुर (छ.ग.) / Koni, Bilaspur (C.G.)

Email **pankajk.gupta@ggu.ac.in**

Re: Reg: Minutes of BOS meeting and Approval

From : alok@nitrkl.ac.in Mon, Aug 17, 2020 08:13 PM
Subject : Re: Reg: Minutes of BOS meeting and Approval
To : pankaj kumar <pankajk.gupta@ggu.ac.in>

APPROVED.

DR. ALOK SATAPATHY
PROFESSOR
DEPT. OF MECHANICAL ENGG
NIT ROURKELA

From: "pankaj kumar" <pankajk.gupta@ggu.ac.in>
To: "alok" <alok@nitrkl.ac.in>
Cc: "vivek singh dvc" <vivek.singh.dvc@gmail.com>, "ssv bit" <ssv.bit@gmail.com>, "arjun nivi" <arjun_nivi@yahoo.com>
Sent: Monday, August 17, 2020 10:32:36 AM
Subject: Reg: Minutes of BOS meeting and Approval

Dear Sir,

The meeting of BOS of Mechanical Engineering was conducted on 10-08-2020 online mode.
Please find attached the MINUTES of Meeting.
You are also requested to APPROVE the agendas discussed in the meeting, in your return mail appended as APPROVED.

Thank you for your time and valuable feedback in the meeting.

Dr. Pankaj Kumar Gupta
ASSOCIATE PROFESSOR
DEPARTMENT OF MECHANICAL ENGINEERING
SCHOOL OF STUDIES ENGINEERING & TECHNOLOGY
GURU GHASIDAS VISHWAVIDYALAYA (A CENTRAL UNIVERSITY)
KONI, BILASPUR, CHHATTISGARH
INDIA - 495009

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SCHOOL OF STUDIES OF ENGINEERING & TECHNOLOGY
GURU GHASIDAS VISHWAVIDHALAYA(A CENTRAL UNIVERSITY)
DEPARTMENT OF MECHANICAL ENGINEERING
CBCS-NEW, STUDY & EVALUATION SCHEME
W.E.F. SESSION 2020-2021

Year: B.Tech. 3rdyear

SEMESTER- V

SN	Course No.	SUBJECT	PERIODS			EVALUATION SCHEME			CREDITS
			L	T	P	INTERNAL ASSESSMENT	ESE	SUB-TOTAL	
1.	ME05TPC07	**Fluid & Turbo Machinery**	3	0	-	30	70	100	3
2.	ME05TPC08	Internal Combustion Engine	3	0	-	30	70	100	3
3.	ME05TPC09	Machine Design – I	3	1	-	30	70	100	4
4.	ME05TPC10	Mechanics of Solid-II	3	1	-	30	70	100	4
5.	ME05TPE02	Professional Elective-02	3	0	-	30	70	100	3
		Total	**15**	**2**	-	**150**	**350**	**500**	**17**
PRACTICALS									
1.	ME05PPC05	Fluid Machinery lab	-	-	2	30	20	50	1
2.	ME05PPC06	Internal Combustion Engine Lab	-	-	2	30	20	50	1
3	ME05PPE01	CAD / CAM Lab			2	30	20	50	1
Total			**0**	**0**	**4**	**90**	**60**	**150**	**3**

Total Credits: 20
Total Contact Hour: 21
Total Marks: 650
*INTERNAL ASSESSMENT- Two Class Test of 15 Marks each will be conducted.
L-LECTURE,T-TUTORIAL,P-PRACTICAL, ESE –END SEMESTER EXAMINATION

ME05TPE02 Professional Elective-02	
ME05TPE21 Innovation and Technology Management	
ME05TPE22 Innovation and Entrepreneurial Skills	
ME05TPE23 **CAD/CAM**	

COURSE TEMPLATE

1.	**Department/Centre proposing the course**	Mechanical Engineering
2.	**Course Title**	Fluid and Turbo Machinery
3.	**L-T-P structure**	3-1-0
4.	**Credits**	4
5.	**Course number**	**ME5TPC07**
6.	**Status** (*category* for *program*)	

7.	**Pre-requisites** (course no./title)	Thermodynamics, Fluid Mechanics
8.	**Status vis-à-vis other courses** *(give course number/title)*	
8.1	Overlap with any UG/PG course of the Dept./Centre	No
8.2	Overlap with any UG/PG course of other Dept./Centre	No
8.3	Supercedes any existing course	No

9		

10	**Frequency of offering**	Every sem ☒ 1st sem ☒ 2nd sem ☒ Either sem ☒
11	**Faculty who will teach the course**	
12	**Will the course require any visiting faculty?**	

13	**Course objective:** • The course aims at giving an overview of different types of fluid machines used for energy transformation, such as hydraulic and steam turbines, gas turbines, compressors, and pumps. • It focuses on applications in power generation, transport, refrigeration. • The main purpose of implementing this course in the curriculum is to learn about how the power is transferred in a turbomachine.

14	**Course contents:** **Unit-1** **Fundamentals:** Classification, Applications of turbomachines, Performance

	parameters, Specific speed, Basic laws and equations, Velocity triangles. **Unit-2** **Hydraulic turbines:** Specific applications, types, construction, working, and performance of various types of hydraulic turbines (Pelton, Francis, and Kaplan turbines), Cavitation in turbines, and water hammer effects, Draft tube: Types, applications, and performance analysis. **Unit -3** **Centrifugal pumps:** Theory, types, components, and working characteristics, Cavitation, NPSH,Priming, Axial flow pumps, Practical problems, and remedies. **Unit-4** **Thermal turbines:** Steam turbine basic cycles, impulse and reaction turbines, Multistage turbines,Governing systems, Effects of reheating and regeneration, Application of Mollier diagram, Gas turbine basic cycle, Application of intercooling, reheating and regeneration, Introduction to wind turbines, Power and efficiency calculations. **Unit-5** **Air compressors:** Radial and axial compressors, Construction and performance analysis, Surging and stalling, Slip.

15. Lecture Outline *(with topics and number oflectures)*

Module no.	Topic	No. of hours
1.	Introduction to turbomachinery, Basic principles, Classification, Impulse and Reaction type, Fundamental equations, Euler's equation, Introduction to hydro-electric power plants, major components, Surge tanks, etc.	05
2.	Hydraulic Turbines: Classification of Turbine, Impulse Turbine, Pelton wheel, Construction and working, Work done, Head efficiency and Design aspects, Governing of Impulse turbine.	06
3.	Radial flow reaction turbine, Francis turbine: Construction and working, Work done, efficiency, Design aspect, Advantages and disadvantages over Pelton wheel.	05
4.	Propeller and Kaplan turbine, Bulb or Tubular turbine, Draft tube, Specific speed, Unit quantities, Cavitation, Degree of reaction, Performance characteristics, Surge tanks, Governing of Reaction turbine.	05
5.	Classification of Pumps, Centrifugal Pump, Construction, Working, Work Done, Heads, Efficiencies, Multistage Centrifugal Pump, Pump in Series and Parallel, Specific Speed, Characteristic, Net Positive Suction Head, Cavitation.	06
6.	Steam Turbines:Classification, Single-stage impulse turbine, condition for maximum blade efficiency, stage efficiency, Need and methods of compounding, Multi-stage impulse turbine, Problems.Parson's turbine, condition for efficiency, reaction staging, Problems.	7
7.	Gas turbine: components, fuels, materials, Different cycle, analysis, Optimum pressure ratio for maximum specific output, the effect of modification on efficiency and output, Ideal and actual cycle.	05

8.	Centrifugal Compressors: Stage velocity triangles, slip factor, power input factor, Stage work,Pressure developed, stage efficiency and surging, and problems.	05
9.	Axial flow Compressors: Expression for pressure ratio developed in a stage, work done factor, efficiencies and stalling. Problems.	05
	COURSE TOTAL	49

16. Brief description of tutorial activities

Primarily numerical problem solving on different topics covered in the lectures.

17. Brief description of laboratoryactivities

Module no.	Experiment description	No. of hours
1	Study of Pelton wheel turbine	03
2	Study of Francis turbine	03
3	Study of the Kaplan turbine	03
4	Study of centrifugal pump	03
5	Study of Velocity triangles for impulse steam turbine	02
6	Study of Velocity triangles for reaction steam turbine	02
7	Study of Velocity triangles for axial flow compressor	02
8	Study of Velocity triangles for centrifugal air compressor	02
9	Study of open cycle gas turbine	02
10	Study of open cycle gas turbine with reheat, regeneration	02
COURSE TOTAL		**12**

18. Suggested texts and reference materials

1. Jagdish Lal, Hydraulic Machines, S. K. Kataria& Sons
2. S. K. Som& G. Biswas, Introduction to Fluid Mechanics and Fluid Machines, TMH
3. C. P. Kotharaman& R. Rudramoorthy, Fluid Mechanics & machinery, New Age Pub
4. R. Yadav, Steam and Gas Turbine, C.P.H. Publication, Allahabad
5. S.M. Yahya,Turbine, Compressors and Fans,TMH.
6. P.K. Nag, Power Plant Engineering,3rd edition, Tata McGraw Hill.
7. V. Ganeshan, Gas Turbine, TMH.
8. D. G. Shepherd, Principle of Turbo Machinery, McMillan.

19. Resources required for the course *(itemized & student access requirements, if any)*

19.1	Software	MATLAB
19.2	Hardware	
19.3	Teaching aids (videos, etc.)	
19.4	Laboratory	Fluid Machine Labs
19.5	Equipment	Various types of turbine and pumps
19.6	Classroom infrastructure	
19.7	Site visits	Thermal and Hydropower projects

20. Designcontentofthecourse*(Percentofstudenttimewithexamples,ifpossible)*

20.1	Design-type problems	10%
20.2	Open-ended problems	

COURSE
TEMPLATE

1.	**Department/Centre proposing the course**	Mechanical Engg
2.	**Course Title**	Computer Aided Design & Manufacturing (CAD-CAM)
3.	**L-T-P structure**	3-0-0
4.	**Credits**	3
5.	**Course number**	ME06TPE23
6.	**Status** (*category* for *program*)	Professional Elective

7.	**Pre-requisites** (course no./title)	Engineering Graphics Machine Drawing
8.	**Status vis-à-vis other courses** *(give course number/title)*	
8.1	Overlap with any UG/PG course of the Dept./Centre	Nil
8.2	Overlap with any UG/PG course of other Dept./Centre	Nil
8.3	Supercedes any existing course	No

9.	**Not allowed for** (indicate program names)	
10.	**Frequency of offering**	Every even semesters
11.	**Will the course require any visiting faculty?**	No
12.	**Course objective** *(about 50 words)*: • To introduce the student to CAD terminology & its capabilities. • To become familiar with CAD software, Graphical user interface & basic tools. • To recognize geometric and graphical elements of engineering design problems • To apply a "hands-on" understanding of the basic concepts of computer-aided manufacturing and prototyping through group and individual projects.	
13.	**Course Outcome** Upon completing the course, the student will be able to: 1. Perceive the concepts of CAD/CAM as well as be able to model analytic and synthetic curves, surfaces and solid models. 2. Compile the NC system and various part programming techniques. 3. Demonstrate group technology and data base management system. 4. Acquire the concepts of design and synthesis of planer mechanisms using computer based applications.	
14.	**Course content** **Basics of CAD**: Basics fundamental of Computer Graphics, Principle of computer graphics, Product life cycle, Concept of Computer Aided Design (CAD) and architecture, Hardware and software, Color management, Raster graphics, Graphics standard, Graphic primitives,	

	lines, and Circle Drawing algorithms, Software documentations, CAD standards GKS, OpenGL, Data exchange standards- IGES, STEP, CALS etc, Communication standards. Standards for vexchange images. **Geometric Modeling of Curves, Surface and Solid**: Basics representation of curves, Parametric and nonparametric curves, Mathematical representation of curves, Hermite curves, Bezier curves, B-spline curves and rational curves. Basic of Surface, Techniques of surface modelling, Plane surface, Rule surface, Surface of revolution and sweep, Coons and bi-cubic patches, concept of Bezier and B-spline surfaces, Basic concept of solid modelling technique, CSG and B-rep method for solid generation. **Geometric Transformation**: Computer Aided Design (CAD) methodology, Coordinate systems, Theory and applications, 2D and 3D geometric transformation, Homogeneous transformation, Concatenation, Assembly modelling, interferences of positions and orientation, tolerance analysis, mass property calculations, Visual realism- hidden line-surface-solid removal algorithms, shading, coloring, computer animation, Concurrent Engineering. **Basics of CAM**: Basic concept of numerical control (NC) System, NC coordinate system, NC motion control, Application of NC, concepts of computer numeric control(CNC) system, problems with conventional, NC, CNC. **Part Programming**: Introduction to NC part programming, manual part programming, Computer assisted part programming, Automatically Programming Tool (APT) language, statements and code of APT, programming methods, advantages of CAD/CAM programming.

15. Lecture Outline *(with topics and number of lectures)*

S.No	Topic	No. of hours
1	**Basics of CAD**	7
2	Basics representation of curves, Parametric and nonparametric curves, Mathematical representation of curves, Hermite curves, Bezier curves, B-spline curves and rational curves.	6
3	Basic of Surface, Techniques of surface modelling, Plane surface, Rule surface, Surface of revolution and sweep, Coons and bi-cubic patches, concept of Bezier and B-spline surfaces	6
4	Basic concept of solid modelling technique, CSG and B-rep method for solid generation.	5
5	Computer Aided Design (CAD) methodology, Coordinate systems, Theory and applications, 2D and 3D geometric transformation, Homogeneous transformation, Concatenation,	5
6	Assembly modelling, interferences of positions and orientation, tolerance analysis, mass property calculations, Visual realism- hidden line-surface-solid removal algorithms, shading, coloring, computer animation, Concurrent Engineering.	6
7	Basics of CAM	5
8	Part Programming	5
	COURSE TOTAL	45

16. Brief description of tutorial activities

NA

17. Brief description of laboratory activities

Module no.	Experiment description	No. of hours

19. Suggested texts and reference materials

STYLE: Book Title, Author name and initials, Edition, Publisher

Text Book:

1. CAD/CAM Theory and Practice-Ibrahim Zeid-Tata McGraw Hill Publications.
2. CAD/CAM-Milkell P. Groover, Emory W. Zimmer-Pearson Education.

Reference book:

20. Resources required for the course *(itemized & student access requirements, if any)*

18.1	Software	Modeling software CATIA/Pro-E etc
18.2	Hardware	Desktops or personal laptops
18.3	Teaching aides (videos, etc.)	Videos, images and animations
18.4	Laboratory	CAD Lab
18.5	Equipment	
18.6	Classroom infrastructure	
18.7	Site visits	

21. Design content of the course *(Percent of student time with examples, if possible)*

20.1	Design-type problems	
20.2	Open-ended problems	
20.3	Project-type activity	Modeling in any professional software:30
20.4	Open-ended laboratory work	
20.5	Others (please specify)	Theory-70

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DEPARTMENT OF MECHANICAL ENGINEERING
CBCS-NEW, STUDY & EVALUATION SCHEME
W.E.F. SESSION 2020-2021

Year: B.Tech. 3rd year

SEMESTER- VI

SN	Course No.	SUBJECT	PERIODS			EVALUATION SCHEME			CREDITS
			L	T	P	INTERNAL ASSESSMENT	ESE	SUB-TOTAL	
1.	ME06TPC11	Heat and Mass Transfer	3	1	-	30	70	100	4
2.	ME06TPC12	Manufacturing Science-II	3	0	-	30	70	100	3
3.	ME06TPE03	Professional Elective-03	3	0	-	30	70	100	3
4.	ME06TOE01	Open Elective-01	3	0	-	30	70	100	3
5.	ME06TOE02	Open Elective-02	3	1	-	30	70	100	4
6.	ME06TMC03	Essence of Traditional Knowledge	3	0	-	-	-	-	-
		Total	**18**	**2**	**-**	**150**	**350**	**500**	**17**
PRACTICALS									
1.	ME06PPC07	Heat and Mass Transfer Lab	-	-	3	30	20	50	1.5
2.	ME06PSC01	Seminar	-	-	2	50	-	50	1
3	ME06PPC08	Manufacturing Science Lab	-	-	3	30	20	50	1.5
Total			**0**	**0**	**6**	**110**	**40**	**150**	**4**

Total Credits: 21
Total Contact Hour: 26
Total Marks: 650
*INTERNAL ASSESSMENT- Two Class Test of 15 Marks each will be conducted.
L-LECTURE,T-TUTORIAL,P-PRACTICAL, ESE –END SEMESTER EXAMINATION

ME06TPE03 Professional Elective-03	**ME06TOE01 Open Elective-01**
ME06TPE31 Measurement Metrology and Control	ME06TOE11 Enterprise Resource Planning
ME06TPE32 Industrial Automation	ME06TOE12 Decision Support and Executive Information System
ME06TPE33 Advanced Manufacturing System	**ME06TOE13 Operations Research**
ME06TOE02 Open Elective-02	
ME06TOE21 Machine Design-II	
ME06TOE22 Mechatronics	
ME06TOE23Robotics and Robot Applications	

Course Template

1.	**Department/Center proposing the course**	Mechanical Engineering
2.	**Course title**	**Heat & Mass Transfer**
3.	**L-T-P Structure**	3-1-0
4.	**Credits**	4
5.	**Course number**	ME06TPC11
6.	**Status (Category for program)**	Program Core

7.	**Pre-requisites**	Engineering Thermodynamics, Fluid Mechanics, Basics of Electrical Circuits (Ohm's Law)

7.1.	Overlap with any UG/PG course of the Dept./Centre	No
7.2.	Overlap with any UG/PG course of other Dept./Centre	Yes, Industrial & Production Engineering (IP6TPE53), Chemical Engineering (**CHPG1101, CH5TPC06**)
7.3.	Super cedes any existing course	No

8.	Not allowed for **(indicate program names)**	

9.	Frequency of offering	Odd Semester
10.	**Faculty who can teach the course**	Fluid-Thermal Group

11.	**Will the course require any visiting faculty**	No

12.	**Course objectives** *(about 50 words):* • To introduce students to fundamentals of heat and mass transfer processes with adequate application examples

13.	**Course outcomes** *(about 50 words):* • Graduates shall be able to apply, analyze and solve elementary problems of engineering interest involving heat transfer mechanisms

14.	**Course contents***(about 100 words) (include laboratory/design activities)*: • **Module-1**: Introduction to modes and mechanisms of heat transfer, Fourier's law, Electrical analogy, Overall heat transfer coefficient, Conduction heat transfer in rectangular, cylindrical and spherical solids, 1-D steady state heat transfer with & without heat generation, critical radius of insulation, Unified view of momentum, heat and mass transfer • **Module-2:** 1-D steady state heat conduction in Extended surfaces, Lumped Capacitance and 1-D transient models, Semi-infinite wall, Error in Temperature measurement, Diffusion mass transfer in 1-D steady state • **Module-3:** Convection: Forced and free convection - mass, momentum and energy conservation equations, scaling analysis and significance of non-dimensional numbers, velocity & thermal boundary layers, heat transfer in external and internal laminar and turbulent flows, and use of correlations, • **Module-4:** Convective mass transfer; Boiling and Condensation: physical phenomena and correlations; Heat Exchanger types and analysis: LMTD and Effectiveness-NTU method • **Module-5:** Radiation heat transfer: Properties, laws, configuration factors, radiation shields, three-surface network of diffuse gray surfaces

15. **Lecture outline***(with topics and number of lectures)*

Module No.	Topics	No. of hours
1	General Introduction: One dimensional	10
	Heat conduction; Introduction to mass transfer	
2	Introduction to extended surfaces	7
	1-D transient heat conduction analysis	
3	Velocity and thermal boundary layer concepts	12
	Forced and Free convection, correlations	

COURSE TEMPLATE

1.	**Department/Centre proposing the course**	Mechanical Engineering
2.	**Course Title**	Operations Research
3.	**L-T-P structure**	3-0-0
4.	**Credits**	3
5.	**Course number**	ME06TOE13
6.	**Status** (*category* for *program*)	Open Elective

7.	**Pre-requisites** (course no./title)	
8.	**Status vis-à-vis other courses** *(give course number/title)*	
8.1	Overlap with any UG/PG course of the Dept./Centre	NA
8.2	Overlap with any UG/PG course of other Dept./Centre	NA
8.3	Supercedes any existing course	NO

9.	**Not allowed for** (indicate program names)	☐ ☐ ☐
10.	**Frequency of offering**	Every sem 1st sem 2nd sem ☒Either sem
11.	**Will the course require any visiting faculty?**	NO
12.	**Course objective** *(about 50 words)*: Knowledge and understanding - Be able to understand the characteristics of different types of decision-making environments and the appropriate decision making approaches and tools to be used in each type. Cognitive skills (thinking and analysis) - Be able to build and solve Transportation Models and Assignment Models. Communication skills (personal and academic). - Be able to design new simple models, like: CPM, MSPT to improve decision – making and develop critical thinking and objective analysis of decision problems. Practical and subject specific skills (Transferable Skills). - Be able to implement practical cases, by using TORA, WinQSB.	
13.	**Course Outcome** At the end of this course, the students will be able to	

	1. Visualize and apply mathematics to obtain analytical solutions in solid mechanics. 2. Interpret the principle of superposition, energy methods of determining the reaction and their applications for solving statically indeterminate structures. 3. Apply the basic concepts of stress and strain in dealing problems related to unsymmetrical bending, fixed beams, continuous beams, curved beams, thick and thin pressure vessels.. 4. Discover principles of solid mechanics by solving engineering problems. 5. Develop appropriate models for practical situations to formulate solutions.
14.	**Course contents** *(about 100 words) (Include laboratory/design activities)*: **UNIT I** Introduction to linear programming: Graphically solution to linear programming problem, solving linear problem by simplex method, optimization problem, maximization & minimization function with or without constraints, sack surplus & artificial, variable method, degeneracy problem. **UNITII** Mathematical statement of the transportation problem: The transportation model, method for basic feasible solution, Degeneracy & unbalance problem, Mathematical statement of the assignment problem, solution of assignment problem, travelling sales-man problem. **UNIT III** Game theory: Rule of game, Method of solving game , graphically & Arithmetic , saddle point &without saddle point , dominance method, mixed strategies 2 X 2game , 2 X N game , M X 2 game , 3 X 3game (Method of matrix's, method of linear programming etc). Inventory: Introduction, classification, function, level, control techniques, models, and various costs associated, EOQ, optimum lot sizing. **UNITIV** Introduction of queuing theory: Elements of queuing system ,operating characteristics of a queuing system, Poisson arrivals & exponential service time , waiting time & idle time cost, single channel queuing theory. Replacement problems: Requirement policy, replacement of items, machinery various themes, group replacement policy, MAPI methods. **UNITV** Network analysis: Introduction of PERT & CPM, computation of PERT, Time estimation, measure of deviation &variation, probability of completing project, Arrow diagram &critical path method, Scheduling, cost analysis & crushing of network.

15. Lecture Outline *(with topics and number oflectures)*

S. No.	Topic	No. of hours
1	Linear Programming, Graphical solution	3
2	Simplex method, Optimization Problem	4
3	Transportation problem	5
4	Assignment problem	4
5	Game theory: Rule of game, Method of solving game , graphically &	3