ವಿಶ್ವೇಶ್ವರಯ್ಯ ತಾಂತ್ರಿಕ ವಿಶ್ವವಿದ್ಯಾಲಯ
ವಿಟಿಯು ಅಧಿನಿಯಮ ೧೯೯೪ರ ಅಡಿಯಲ್ಲಿ ಕರ್ನಾಟಕ ಸರ್ಕಾರದಿಂದ ಸ್ಥಾಪಿತವಾದ ರಾಜ್ಯವಿಶ್ವವಿದ್ಯಾಲಯ
VISVESVARAYA TECHNOLOGICAL UNIVERSITY
State University of Government of Karnataka Established as per the VTU Act, 1994"JnanaSangama" Belagavi-590018, Karnataka, India

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REGISTRAR

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REF: VTU/BGM/AC KGTTI/1000/2025-26/ 1466 DATE: 30 JUN 2026

NOTIFICATION

Subject: Inclusion of **Operations Research (BME714E)** as an additional Professional Elective Course for VII Semester B.E. Mechanical Engineering under the 2022 Scheme – Reg.

Reference: No.JCER/Aca/2026-27/180, Dated: 15.06.2026
Email dated **15.**06.2026
The hon'ble Vice-Chancellor's approval dated: 27.06.2026

With the approval of the competent authority and based on the recommendation of the Board of Studies in Mechanical Engineering, **Operations Research (BME714E)** is hereby included as an **additional Professional Elective-III course** for **VII Semester B.E. Mechanical Engineering** students admitted under the 2022 Scheme.

The syllabus has been attached to this circular for stakeholder's reference and use. This addition is intended to provide students with an additional elective option and to enhance their knowledge in industrial decision-making and optimization.

All Principals of affiliated engineering colleges are informed to bring the contents of this circular to the notice of the concerned students, faculty members, and examination coordinators, and implement the same with immediate effect.

Raw/30/06/26
REGISTRAR

To
The principals of all affiliated (Constituent / non-autonomous) engineering colleges
The Chairpersons/Programme coordinators of university departments at Kalburgi, Belagavi, Bengaluru(Mudenhalli), Mysuru and Talkal

Copy to

1. The Registrar (Evaluation) VTU Belagavi for information needful
2. The Director, ITI, SMU, VTU Belagavi for information and request to upload the circular on university web site.
3. The Special Officer, QPDS, Section VTU Belagavi for information and needful (Copy to P. Manjunath)
4. The Special Officer CoE, Mysuru for information.
5. The office copy.

OPERATIONS RESEARCH		Semester	7th
Course Code	BME714E	CIE Marks	50
Teaching Hours/Week (L: T:P: S)	3:0:0:0	SEE Marks	50
Total Hours of Pedagogy	40	Total Marks	100
Credits	03	Exam Hours	03
Examination type (SEE)	Theory		

Course objectives:

- To introduce students to use quantitative methods and techniques for effective decisions–making;
- Mathematical model formulation and solving business decision problems.

Teaching-Learning Process (General Instructions)

These are sample Strategies, which teachers can use to accelerate the attainment of the various course outcomes.

1. Use of Chalk and Talk method
2. Video lectures, lecture projections in class
3. Individual and Group assignments

Module-1

Introduction: Evolution of OR, definition of OR, scope of OR, application areas of OR, steps (phases) in OR study, characteristics and limitations of OR, models used in OR, linear programming (LP) problem-formulation and solution by graphical method. The simplex method using slack variables.

Module-2

Transportation Problem: Formulation of transportation problem, types, initial basic feasible solution using different methods, optimal solution by MODI method, degeneracy in transportation problems, application of transportation problem concept for maximization cases. **Assignment Problem:** Formulation, types, application to maximization cases and travelling salesman problem.

Module-3

PERT-CPM Techniques: Introduction, network construction - rules, Fulkerson's rule for numbering the events, AON and AOA diagrams; Critical path method to find the expected completion time of a project, floats; PERT for finding expected duration of an activity and project, determining the probability of completing a project, predicting the completion time of project; crashing of simple projects.

Module-4

Game Theory: Formulation of games, types, solution of games with saddle point, graphical method of solving mixed strategy games, dominance rule for solving mixed strategy games.

Queuing Theory: Queuing systems and their characteristics, Pure-birth and Pure-death models (only equations), empirical queuing models (M/M/1 model).

Module-5

Sequencing: Basic assumptions, sequencing 'n' jobs on single machine using priority rules, sequencing using Johnson's rule-'n' jobs on 2 machines, 'n' jobs on 3 machines, 'n' jobs on 'm' machines. Sequencing 2 jobs on 'm' machines using graphical method.

Course outcome (Course Skill Set)

At the end of the course, the student will be able to :

- Understand the importance, phases, & limitations of operations research.
- Formulate a real-world problem in OR as a mathematical model.
- Apply PERT and CPM network techniques to solve project management problems.
- Choose appropriate OR models to solve transportation problem, assignment model, game theory, queuing theory and sequencing models.

Assessment Details (both CIE and SEE)

The weightage of Continuous Internal Evaluation (CIE) is 50% and for Semester End Exam (SEE) is 50%. The minimum passing mark for the CIE is 40% of the maximum marks (20 marks out of 50) and for the SEE minimum passing mark is 35% of the maximum marks (18 out of 50 marks). A student shall be deemed to have satisfied the academic requirements and earned the credits allotted to each subject/ course if the student secures a minimum of 40% (40 marks out of 100) in the sum total of the CIE (Continuous Internal Evaluation) and SEE (Semester End Examination) taken together.

Continuous Internal Evaluation:

- The CIE is the sum of Average of Two Internal Assessment Tests each of 25 marks and Any two Assessment methods for 25 marks.
- The first test will be administered after 40-50% of the syllabus has been covered, and the second test will be administered after 85-90% of the syllabus has been covered
- Any two assessment methods mentioned in the 22OB4.2, if an assignment is project-based then only one assignment for the course shall be planned. The teacher should not conduct two assignments at the end of the semester if two assignments are planned.
- For the course, CIE marks will be based on a scaled-down sum of two tests and other methods of assessment for a total of 50 marks.

Internal Assessment Test question paper is designed to attain the different levels of Bloom's taxonomy as per the outcome defined for the course.

Semester-End Examination:

Theory SEE will be conducted by University as per the scheduled timetable, with common question papers for the course (**duration 03 hours).**

- The question paper will have ten questions. Each question is set for 20 marks.
- There will be 2 questions from each module. Each of the two questions under a module (with a maximum of 3 sub-questions), **should have a mix of topics** under that module.
- The students have to answer 5 full questions, selecting one full question from each module.
- Marks scored shall be proportionally reduced to 50 marks

Suggested Learning Resources:

Books

1. **Operations Research,** P K Gupta and D S Hira, 7th Edition, Chand Publications, New Delhi
2. **Operations Research,** R. Panneerselvam, 3rd Edition, PHI
3. **Operations Research Theory, Methods & Applications,** S.D. Sharma, Kedarnath Ramanath & Co, 2012.
4. **Operations Research**, A M Natarajan, P Balasubramani, Pearson Education, 2005
5. **Introduction to Operations Research**, Hillier and Lieberman, 8th Edn, McGraw Hill,

Web links and Video Lectures (e-Resources):

- https://nptel.ac.in/courses/112106134

Activity Based Learning (Suggested Activities in Class)/ Practical Based learning

- Use appropriate software tools to solve real world problems Operations Research for different businesses

VISVESVARAYA TECHNOLOGICAL UNIVERSITY, BELAGAVI

B.E. in Mechanical Engineering

Scheme of Teaching and Examinations2022

Outcome Based Education (OBE) and Choice Based Credit System (CBCS)

(Effective from the academic year 2023-24)

Scheme A- VIISEMESTER (Swappable VII and VIII SEMESTER)

Sl. No	Course and Course Code		Course Title	Teaching Department (TD) and Question Paper Setting Board (PSB)	Teaching Hours /Week				Examination				Credits
					Theory Lecture	Tutorial	Practical/ Drawing	Self -Study	Duration in hours	CIE Marks	SEE Marks	Total Marks	
					L	T	P	S					
1	IPCC	BME701	Finite Element Methods	TD: ME PSB:ME	3	0	2		03	50	50	100	4
2	IPCC	BME702	Hydraulics and Pneumatics	TD: ME PSB:ME	3	0	2		03	50	50	100	4
3	PCC	BME703	Control Engineering	TD: ME PSB:ME	4	0	0		03	50	50	100	4
4	PEC	BME714x	**Professional Elective-III**	TD: ME PSB:ME	3	0	0		03	50	50	100	3
5	OEC	BME755x	**Open Elective- II**	TD: ME PSB:ME	3	0	0		01	50	50	100	3
6	PROJ	BME786	**Major Project Phase-II**		0	0	12		03	100	100	200	6
										400	**300**	**700**	**24**

Professional Elective Course

BME714A	Additive manufacturing	BME714C	IC Engines
BME714B	Product Design and Management	BME714D	Cryogenics
		BME714E	**Operation Research**

Open Elective Course

BME755A	Introduction to Non-Traditional machining	BME755C	Operations Research
BME755B	Basics of Hydraulics and Pneumatics	BME755D	Non-Conventional Energy Resources

PCC: Professional Core Course, **PCCL**: Professional Core Course laboratory, **PEC**: Professional Elective Course, **OEC**: Open Elective Course PR: Project Work, **L:** Lecture, **T**: Tutorial, **P**: Practical **S= SDA**: Skill Development Activity, **CIE**: Continuous Internal Evaluation, **SEE**: Semester End Evaluation. **TD-** Teaching Department, **PSB**: Paper Setting department, **OEC**: Open Elective Course, **PEC**: Professional Elective Course. **PROJ**: Project work

Note: VII and VIII semesters of IV years of the program