INDIAN INSTITUTE OF TECHNOLOGY, KHARAGPUR
End-Autumn Semester 2018-19

Date of Examination : _____ **Session (FN/AN)** _____ **Duration** 3 hrs
Subject No. : EP 60044 _____ **Subject Name : Frugal Engineering** _____
Department/Center/School : Rajendra mishra School of Engineering Entrepreneurship ____
Specific charts, graph paper, log book etc., required _____
Special Instructions (if any) : _____

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1. (a) Illustrate the features of frugality in the Nano car of Tata Motors, which is a milestone of Frugal Engineering and (b) the SWOT Analysis associated with it. [3+1]

2. Discuss the frugality of ISRO's Mars Orbiter Mission or Mangalyaan including technology adaptation. [4]

3. Elucidate the features of GE's Vscan (Ultrasound Device Healthcare). [4]

4. Explicate the frugal features and SWOT analysis in the context of 'Embrace Infant Warmer'. [4]

5. Present the frugality aspect of Mechanical Tree Climber. [4]

6. (a) Following are the five alternative design concepts (ALT-1 through ALT-5) for an engineering product. Evaluate the concepts, using appropriate method, and recommend the most suitable one.

CRITERIA	WEIGHT (1 – 10)	ALT -1	ALT -2	ALT -3	ALT -4	ALT -5
FRONTAL IMPACT (kg/cm^2)	8	3255	2840	1720	2487	1849
ROLL OVER (cm)	7	2030	2290	1985	2546	2310
CG HIGHT (cm)	8	24.15	25.20	24.85	24.87	24.36
TORSIONAL STIFFNESS Degrees/Nm	9	482	515	658	457	650
TORSIONAL STIFFNESS To WEIGHT RATIO	10	17.7	18.5	31.3	17.9	23.7

(b) Illustrate with the help of a diagram, the Morphological Chart in the context of concept generation. [3+3]

7. (a) Illustrate the contradiction matrix of TRIZ and elucidate the inventive principles.

(b)Elucidate the Reverse Engineering (RE) Methodology with the help of a diagram showing the redesign approaches [4+3]

8. (a) Describe the steps followed in Value Engineering and (b) the FMEA Methodology. [3+4]

9. (a) Illustrate the QFD process with a chosen example considering five 'Technical Descriptors' and four 'Çustomer Requirements'. Assume necessary data for relationship matrix and "Importance'. Determine the Relative Weights of the Technical Descriptors as row vector, showing detailed computation for the first column. [4]

10. Briefly discuss (a) Taguchi Loss Function and (b) Parameter Design [3+3]