INDIAN INSTITUTE OF TECHNOLOGY KHARAGPUR

Mid-Spring Semester Examination 2022-23

Date of Examination: 15 Feb 2023 **Session:** (FN/AN) AN **Duration:** 2 hrs. **Full Marks:** 40

Subject No.: AG30204

Subject: OFF-ROAD VEHICLE SYSTEMS

Department/Center/School: Agricultural and Food Engineering Department

Specific charts, graph paper, log book etc., required NO

Special Instructions (if any): Attempt all questions; Approximate points distribution is indicated against the corresponding question; Strictly, all components of a question must be answered at the same place; Make logical assumptions, wherever needed, and clearly state the reason and the value; No queries will be entertained during the examination

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Q.1 Explain, with neat sketches, the key design considerations related to modern tractor and its engine. Discuss how the newer designs offer fuel economy, efficiency, safety along with reliability? (4 + 1)

Q.2 Discuss how the off-road vehicles are different from the on-road vehicles. List different types of off-road vehicles. Describe their salient features and their usage under specific conditions. (1 + 3 + 3)

Q.3 With the help of neat sketches, describe the following steering mechanisms used in off-road vehicles: (0.5 x 8)

a) Front-wheel steering
b) Rear-wheel steering
c) Four-wheel steering
d) Twin-axle steering
e) Articulated frame steering
f) Articulated and axle steering
g) Skid-steering
h) Crab-steering

Q.4 Explain in detail, the key components and working of an *in-line type diesel fuel system*. With the help of neat annotated sketches, describe the construction and operation of a *fuel injection pump* (3 + 3)

Q.5 What are the key assumptions made in "*air-standard cycle*" in contrast with an "*ideal cycle*"? An air-standard diesel cycle operates at a compression ratio of 16:1. The cylinder bore is 200 mm and the stroke is 300 mm. Compression begins at 1 bar and 27 deg. C. The cut-off ratio is 2.2. Ratio of specific heats (γ) can be taken as 1.4. Determine: (2 + 2 x 4)

a) Pressure, volume and temperature of all four states in the diesel cycle
b) Work done per cycle
c) Air standard efficiency
d) Mean pressure

Q.6 Write short-notes on: (2 x 4)

a) AWD vs 4WD vs MFWD
b) Quad track tractor vs Full track tractor
c) Octane number vs Cetane number
d) Working of SI engine vs Working of CI engine

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