Manipal Institute of Technology, Manipal

(A Constituent Institute of Manipal University)

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IV SEMESTER B.TECH (AERONAUTICAL & AUTOMOBILE ENGINEERING)
END SEMESTER EXAMINATIONS, MAY 2016

SUBJECT: AUTOMOTIVE TRANSMISSION SYSTEM [AAE 2251]
REVISED CREDIT SYSTEM

Time: 3 Hours   MAX. MARKS: 50

Instructions to Candidates:

❖ Answer **ALL** the questions.

❖ Missing data may be suitable assumed.

1A.	Briefly discuss about different friction materials used on the driven plate in clutches for heavy duty applications.	**(03)**
1B.	With a neat sketch and a relevant characteristic plot, illustrate the working principle of a plate type centrifugal clutch.	**(04)**
1C.	Find the axle shaft diameter for an automobile developing a maximum torque of 190 N- m with the final drive ratio of 4.5:1 and bottom gear ratio of 3:1. It has an effective wheel diameter of 0.75 m and the friction coefficient between the tire and the terrain as 0.5. If permissible shear stress is 3300 bar, calculate the maximum load permissible on each wheel.	**(03)**
2A.	What are hydrostatic drives? With a neat sketch, illustrate the working of a wobble plate type variable displacement pump.	**(04)**
2B.	What are the functions of hydraulic control system in automatic transmissions? List the signal pressures applied at the gear shift valves.	**(02)**
2C.	A single plate clutch is to be designed for transmitting a maximum torque of 370 N-m. A maximum wear of facings of 5 mm is to be allowed. Design with a safety factor of 25 % with a safe pressure intensity of 185 kN/m^2 normal to the surface, assuming the ratio of diameters as 0.6. Find the dimensions of the clutch. Assume uniform wear theory. If 9 springs are used and initial spring force is 20 % more than the spring force after allowable wear of 5 mm, find the spring stiffness. Assume μ=0.35	**(04)**
3A.	Illustrate the working principle of gear selector and interlocking mechanism for manual transmission systems.	**(03)**
3B.	With a relevant diagram, explain how the driving thrust is stabilized in automobiles with open propeller shafts.	**(03)**
3C.	A constant mesh gear box giving 4 forward speeds has the drive pinion with 15 teeth and large meshing gear on lay shaft has 30 teeth. The 3rd, 2nd and 1st gears on lay shaft have 28, 22 and 18 teeth respectively.	**(04)**

   (i)Find the gear ratios of the gear box   (ii) Draw a layout and obtain the speeds of the vehicle in different gears for an effective wheel size of 500mm when the engine runs constantly at 2050 rpm. The final drive ratio is 5:1.

4A. With a neat sketch, discuss how the various loads are borne in a ¾ floating rear axle. **(04)**

4B. A vehicle with a gross weight of 21300 N has equal weight distribution between the axles. Its wheel base is 3 m and center of gravity is 55cm above the road surface. The coefficient of friction between the tires and road surface is 0.6. Find the % gradiability of the vehicle when driven on
(i) Front wheels only   (ii) Rear wheels only. **(04)**

4C. What are continuously variable transmission systems? Briefly Explain any one such system. **(02)**

5A. Explain the constructional details and different working modes of a torque converter. **(04)**

5B. Define critical speed of rotating shafts. What are the parameters that affect critical speed of automotive propeller shafts? **(02)**

5C. For a motor car, the road resistance is 25 N/ 1000 N of weight of vehicle and air resistance is estimated as $0.083 V^2$, where V is speed of vehicle in Kmph, transmission efficiency=86 %. The weight of the vehicle is 19,922 N. **(04)**
Find (i) The engine power required for a top speed of 140 kmph.
(ii) Acceleration of the vehicle at 45 kmph assuming that tractive effort at 45 kmph in top gear is 24 % greater than that at 140 kmph.
(iii) Power required to drive up a gradient of 1 in 5 at 45 kmph with an efficiency of 80 % in lower gear.