

SIDDHARTH INSTITUTE OF ENGINEERING & TECHNOLOGY: PUTTUR (AUTONOMOUS)

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**QUESTION BANK (DESCRIPTIVE)****Subject with Code: 20AG0727 TRACTOR DESIGN AND TESTING Course & Branch: BTECH&AGE****Year & Sem: IV YEAR & I SEMISTER****Regulation: R20****UNIT –I**

Design and development of agricultural tractors- Classification and section of tractors. Parameters to be considered for design of tractors and trends in tractor. Study of parameters for design of tractor for stability, weight transfer in tractors and location of centre of gravity

1	Write about hierarchical development in tractor design.	[L1][CO1]	[12M]
2	a) Explain about classification of tractors. b) Write about global variations in tractor design.	[L2][CO1] [L1][CO1]	[6M] [6M]
3	a) Explain about future trends in tractor design. b) Write about different types of tractors.	[L2][CO1] [L1][CO1]	[6M] [6M]
4	Explain about static equilibrium of tractor with neat sketch.	[L2][CO1]	[12M]
5	a) Explain about weight transfer phenomenon. b) Explain about the maximum drawbar pull.	[L2][CO1] [L2][CO1]	[6M] [6M]
6	a) Explain about the longitudinal stability of tractor at no load when tractor moving uphill with diagram. b) A tractor weighing 28 kN has wheel base of 2150 mm and moving uphill at no load. Its c.g. is located 900 mm ahead of centre of rear wheel axle and 750 mm above the ground surface. Determine the maximum uphill slope the tractor can climb without overturning backwards.	[L2][CO1] [L3][CO1]	[6M] [6M]
7	a) Explain about the longitudinal stability of tractor at no load when tractor moving downhill with diagram. b) A tractor weighing 28 kN has wheel base of 2150 mm and moving downhill at no load. Its c.g. is located 900 mm ahead of centre of rear wheel axle and 750 mm above the ground surface. Determine the maximum downhill slope the tractor can move safely without overturning foreword.	[L2][CO1] [L3][CO1]	[6M] [6M]
8	A tractor with a total weight of 30 kN having wheel base of 2200 mm has c.g. located 800 mm ahead of centre of rear axle. It pulls a drawbar load of 16 kN at drawbar at an angle of 15 degree with the horizontal. The hitch point is located 400 mm above ground surface 300 mm behind the centre of rear axle. Calculate the reactions on rear and front wheels of tractor. Also calculate the weight transfer to rear wheel occurring due to above pull developed by the tractor.	[L3][CO1]	[12M]
9	What is mean by center of gravity. Explain about determination of center of gravity by weighing method with neat sketch.	[L1][CO1]	[12M]
10	A tractor has following specifications: Total weight of tractor, $W = 25 \text{ kN}$ Wheel base $L = 2170 \text{ mm}$ Diameter of rear wheels $d_r = 1450 \text{ mm}$ Diameter of front wheels, $d_f = 740 \text{ mm}$ Weight of front wheels on level ground, $N_f = 8.5 \text{ kN}$ Weight on front wheels when lifted 420 mm above ground. $N_f' = 7.5 \text{ kN}$ Determine the location of c.g. of tractor.	[L3][CO1]	[12M]

UNIT –II

Traction theory, hydraulic lift and hitch system design. Complete drive train, transmission types, friction brakes and clutches. Bevel gears, gear design. Differentials and transmission shaft. Design of single disc, multi disc and cone clutches. Design of Rolling friction and anti-friction bearings.

1	<p>a) Explain about the traction theory.</p> <p>b) Determine traction force developed by a track type wheel 30 cm wide and 150 cm contact length weighing 15 KN moving on a soil having following parameters: $C = 1.3 \text{ N/cm}^2$; $K_c = 3$; $\Phi = 28 \text{ deg}$ Assume that lugs on the track are such that the soil is sheared off in a plane area at ends of lugs.</p>	[L2][CO2] [L3][CO2]	[6M] [6M]
2	Explain about the hydraulic system of a tractor with neat sketch.	[L2][CO2]	[12M]
3	<p>a) Explain about the final drive of a tractor.</p> <p>b) Explain about the bearings.</p>	[L2][CO2] [L2][CO2]	[6M] [6M]
4	<p>a) What are the design requirements of the hitch system for farm machinery.</p> <p>b) Explain about the power transmission system with neat sketch.</p>	[L1][CO2] [L2][CO2]	[6M] [6M]
5	<p>a) What is clutch. Write types, advantages and disadvantages of friction clutch.</p> <p>b) What are the materials used for the friction surfaces and write about applications of friction clutch.</p>	[L1][CO2] [L1][CO2]	[6M] [6M]
6	Explain about the different tractor transmission types.	[L2][CO2]	[12M]
7	<p>a) What are the design considerations for gearbox of a tractor.</p> <p>b) Explain about the differential unit of the tractor.</p>	[L1][CO2] [L2][CO2]	[6M] [6M]
8	<p>a) Determine the maximum, minimum and average pressure in plate clutch when the axial force is 4 kN. The inside radius of the contact surface is 50 mm and the outside radius is 100 mm. Assume uniform wear.</p> <p>b) A single plate clutch, with both sides effective, has outer and inner diameters 300 mm and 200 mm respectively. The maximum intensity of pressure at any point in the contact surface is not to exceed 0.1 N/mm². If the coefficient of friction is 0.3, determine the power transmitted by a clutch at a speed 2500 r.p.m.</p>	[L3][CO2] [L3][CO2]	[6M] [6M]
9	<p>A plate clutch having a single driving plate with contact surfaces on each side is required to transmit 110 kW at 1250 r.p.m. The outer diameter of the contact surfaces is to be 300 mm. The coefficient of friction is 0.4.</p> <p>(a) Assuming a uniform pressure of 0.17 N/mm²; determine the inner diameter of the friction surfaces.</p> <p>(b) Assuming the same dimensions and the same total axial thrust, determine the maximum torque that can be transmitted and the maximum intensity of pressure when uniform wear conditions have been reached</p>	[L3][CO2] [L3][CO2]	[12M]
10	<p>a) Explain about the design of single plate or disc clutch.</p> <p>b) Explain about the design of cone clutch.</p>	[L2][CO2] [L2][CO2]	[6M] [6M]

UNIT –III

Steering system-Qualities of steering system, steering geometry, design of Ackerman steering. Working of hydraulic or power steering- maintenance. Steering and front-end trouble shooting. Study of special design features of tractor engines and their selection.

1	a) Explain about the steering system of tractor. b) Write about good steering qualities of tractor.	[L2][CO3] [L1][CO3]	[6M] [6M]
2	Explain about mechanical steering system of tractor with components.	[L2][CO3]	[12M]
3	Explain about power steering system of tractor with components.	[L2][CO3]	[12M]
4	a) Explain about pumps in power steering system. b) If a hydraulic pump is rotating at a speed of 2000 rpm with a displacement of 25 cc/rev. Calculate the theoretical discharge of pump. If the pump has a volumetric efficiency of 90% how much flow is created by the pump?	[L2][CO3] [L3][CO3]	[6M] [6M]
5	a) Explain about actuators in power steering system. b) If a 250-N force is applied to the top of a piston of hydraulic actuator and the force produces 750 Pa of pressure. Determine the area as well as diameter of the piston?	[L2][CO3] [L3][CO3]	[6M] [6M]
6	Explain about steering geometry of tractor.	[L2][CO3]	[12M]
7	Write about characteristics of pumps.	[L1][CO3]	[12M]
8	a) If a pump delivers 30lpm at 40 MPa, how much fluid power the pump develops? b) A hydraulic pump of a power steering requires 9 kW input power to deliver 20 lpm of hydraulic oil at 20 MPa. The pump capacity is 25 lpm. Determine the pump efficiencies.	[L3][CO3] [L3][CO3]	[6M] [6M]
9	a) Determine the theoretical and actual fluid discharge and mechanical (input). power for a pump delivering 50 lpm with a pressure rise of 20MPa if volumetric and mechanical (torque) efficiencies of the pump are 95% and 90%, respectively. b) what maximum flow could you expect from a 10kW power unit if the hydraulic system pressure was 30MPa.	[L3][CO3] [L3][CO3]	[6M] [6M]
10	Explain about the Ackerman steering system of tractor.	[L2][CO3]	[12M]

UNIT –IV

Design of cylinder, piston, piston pin, crankshaft, seat and controls of an agricultural tractor. Tractor hydraulic systems-principle of hydraulics, working of hydraulic system, components of hydraulic circuits and different values. Tractor hydraulic systems, principle of hydraulics, working of hydraulic system, components of hydraulic circuits and different values

1	Explain about the Engine terminology?	[L2][CO4]	[12M]
2	What is mean by horsepower? Explain about different types with formulas?	[L1][CO4]	[12M]
3	a) A four-stroke cycle diesel engine of a tractor is developing a mean effective pressure of 10 bars. It develops a power of 25 kW while running at a speed of 2200 rpm. Take stroke bore ratio as 1.2; calculate the bore and stroke of engine. b) A four-stroke cycle diesel engine has stroke bore ratio of 1.25. The mean effective pressure recorded was 0.8 MPa. The engine is producing indicated power of 23.5 kW while running at 2000 rpm. Determine the dimensions of engine.	[L3][CO4] [L3][CO4]	[6M] [6M]
4	a) A four cylinder, 4-stroke cycle diesel engine develops 40 kW power at 35 revolutions/s. The mean effective pressure in each cylinder is 85 bars and mechanical efficiency of engine is 80% Calculate the following 1. Diameter of cylinder 2. Stroke of piston if stroke bore ratio is 1.25:1. b) A single cylinder four stroke cycle diesel engine of a tractor is having sweptvolume of 1050cm ³ and is tested at 30 rev/s. A braking torque of 70 Nm and indicator diagram gave a mean effective pressure of 10.5 bars. Calculate the following for the engine: 1) Brake power ii) Mechanical efficiency	[L3][CO4] [L3][CO4]	[6M] [6M]
5	Explain about the cylinder and cylinder head in tractor engine?	[L2][CO4]	[12M]
6	a) Explain about the piston? b) Explain about the design of crankshaft?	[L2][CO4] [L2][CO4]	[6M] [6M]
7	a) What is mean by Ergonomics? Explain about the work place layout of tractor? b) Explain about the design of instrument panel tractor?	[L1][CO4] [L2][CO4]	[6M] [6M]
8	Explain about the design of operator seat in tractor with neat sketch?	[L2][CO4]	[12M]
9	a) Explain about the Hand controls in tractor? b) Write about the location of the hand controls in tractor?	[L2][CO4] [L1][CO4]	[6M] [6M]
10	a) Explain about the Foot controls in tractor? b) Write about the location of the foot controls in tractor?	[L2][CO4] [L1][CO4]	[6M] [6M]

UNIT –V

Hydraulic controls- Position control system. Draft control system. Maintenance and repair of hydraulic system. Tractor engines-types, special design features, technical terms and specifications. Tractor testing- Introduction, testing and evaluation system in India, test facility in India. Types of tests- field test, lab test, power test and different types of dynamometers engine performance curves.

1	a) The indicated horse power of a SI engine is 30 hp and brake horse power of the engine is 20 hp. Calculate the frictional horse power.	[L3][CO5]	[6M]
	b) Calculate the brake power of a 2-cylinder 4 stroke cycle IC engine 12×15 cm. The mean effective pressure is 700 kPa and speed of crankshaft is 1200 rpm. The mechanical efficiency is 75%.	[L3][CO5]	[6M]
2	a) Calculate the brake power of 4 stroke 4-cylinder IC engine, having cylinder bore 125mm, stroke length 150mm, crankshaft speed(n) 1000 rpm, mean effective pressure 700 kPa and frictional power of engine is 20 Kw.	[L3][CO5]	[6M]
	b) A four-cylinder four stroke engine having cylinder bore 7.5 cm and stroke length 10 cm develops 15 kW at 1650 rpm. Assuming a mechanical efficiency of 85 %, find indicated power and mean effective pressure.	[L3][CO5]	[6M]
3	a) A four-cylinder 4 stroke gas engine has cylinder diameter of 25 cm, stroke bore ratio is 1.8, clearance volume 4500 cm ³ , engine speed 240 rpm, mean effective pressure 700 kPa and mechanical efficiency is 75%. Calculate (i) indicated power, (ii) brake power, (iii) compression ratio, (iv) swept volume.	[L3][CO5]	[6M]
	b) A diesel engine was tested with a prony brake, having a tare of 22 kg. The brake drum was 60 cm long. At a certain setting of fuel pump the engine run 1140 rpm and gross weight on the brake scale showed 222 kg. Find the (i) power of the engine, (ii) crankshaft torque.	[L3][CO5]	[6M]
4	What is certification scheme. Write about advantages of certification scheme.	[L1][CO5]	[12M]
5	Explain about commercial and confidential tests carried out by BIS.	[L2][CO5]	[12M]
6	Define testing and evaluation. Explain about the procedure of testing.	[L1][CO5]	[12M]
7	a) Explain about the BIS testing procedure of Tractor.	[L2][CO5]	[6M]
	b) Explain about the BIS testing procedure of Power tiller.	[L2][CO5]	[6M]
8	Explain about the Quality system.	[L2][CO5]	[12M]
9	Explain about the ISO standards.	[L2][CO5]	[12M]
10	Explain about the standaradization efforts.	[L2][CO5]	[12M]

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