B.Tech FIFTH SEMESTER EXAMINATION JUNE-2025

(Branch : Mechanical Engineering)

ME-5301 DYNAMICS OF MACHINES

Time   :   Three Hours

Maximum Marks : **70**
Min. Pass Marks : **22**

Note : Attempt any five questions. Each question carries equal marks. Assume missing/misprint data suitably if required

1(a) Define and explain inertia force and inertia torque.   **04**

(b) The length of the connecting rod of a vertical double acting steam engine is 1.5 m. The diameter of the cylinder is 400 mm and stroke of the engine is 600 mm. The crank is rotating at 200 r.p.m. in the clockwise direction. The crank has turned through 40° from the top dead centre and piston is moving downwards. The steam pressure above the piston is 0.6 N//mm^2 and below the piston is 0.05 N/mm^2. The mass of the reciprocating parts is 200 kg. The diameter of piston rod is given as 50 mm. Find the thrust on guide bars and crank-shaft bearing and also turning moment on crank-shaft.   **10**

2(a) What is turning moment diagram?   **04**

(b) The torque exerted on the crank-shaft of a two stoke engine is given by the equation :   **10**

$$T(\text{N-m}) = 14500 + 2300 \sin 2\theta - 1900 \cos 2\theta$$

where θ is the crank angle displacement from the inner dead centre. Assuming the resisting torque to be constant, determine :

(i)   the power developed when the speed is 150 r.p.m.,
(ii) the moment of inertia of the flywheel if the total fluctuation of speed is not to exceed 1% of the mean speed;
(iii) the angular acceleration of flywheel when the crank has turned through 30° from the inner dead centre.

3(a) What is the function of governor, give its classification?   **04**

(b) All the arms of a Porter governor are 250 mm long. The upper arms are hinged at a distance of 40 mm from the axis of rotation whereas the lower arms are pivoted at a distance of 50 mm from the axis of rotation. The mass of each ball is 2.5 kg and mass of sleeve is 25 kg. The force of friction on the sleeve is 20 N. The masses revolve at a radius of 125 mm at minimum speed and at a radius of 150 mm at maximum speed. Determine the range of speed.   **10**

4(a) Define the terms: Sensitiveness, stability, hunting and isochronisms of governor.   **04**

(b) The mass of each ball in a Wilson-Hartnell type of governor is 2.5 kg. The length of ball arm of each bell-crank lever is 100 mm whereas the length of the sleeve arm of bell-crank lever is 80 mm. The minimum equilibrium speed is 200 r.p.m. when radius of rotation is 100 mm. When the sleeve is lifted by 8 mm, the equilibrium speed is 212 r.p.m. The stiffness of each of the springs connected to the balls is 200 N/m. The lever for the auxiliary spring is pivoted at the mid-point. Find the stiffness of the auxiliary spring.   **10**

5   A shaft carries four rotating masses A,B,C and D in this order along its axis. The mass A **14**
may be assumed to be concentrated at a radius of 18 cm, B of 24 cm, C of 12 cm and D of
15 cm. The masses of B, C and D are 30 kg, 50 kg and 40 kg respectively. The planes
containing B and C are 30 cm apart. The angular spacing of the planes containing C and D
are 90° and 210° respectively relative to B measured in the same plane. If the shaft and
masses are to be in complete dynamic balance, find :-

(i)   the mass and the angular position of mass A,
(ii) the position of planes A and D.

6   The cranks of a two cylinder uncoupled outside cylinder locomotive are at right angles and **14**
are 300 mm long. The distance between the centre lines of the cylinder is 1.8 m. The
wheel centre lines are 1.4 m apart. The rotating mass per cylinder is 350 kg and the mass
of the reciprocating parts per cylinder is 285 kg. The whole of the rotating and two third of
the reciprocating masses are to be balanced in the plane of the driving wheels at a radius of
800 mm, then find :

(i)   The magnitude and angular positions of balance masses,
(ii) The maximum speed of the locomotive in kg/hr without lifting the wheels from the
      rails if the dead load (or static load) on each driving wheel is 28000 N and dia of the
      driving wheel is 1.8 m, and
(iii) Swaying couple at the maximum speed.

7(a) Prove that the ratio of two successive amplitudes in case of under-damped system is **07**
constant.

 (b) A shaft is simply supported at the ends and is of 20 mm in diameter and 600 mm in length. **07**
The shaft carries a load of 19.62 N at its centre. The weight of shaft per metre length is
248.2 N. Find the critical speed of the shaft. Take Young's modulus $= 200$ GN/m^2.

8   Write short notes on **any three** :
         (i)   Balancing of primary and secondary force   **14**
         (ii)   Direct and reverse crank method
         (iii)   Forced vibration
         (iv)   Fly-wheel for punching press
         (v)   Principle of Centrifugal governor

*****

B.Tech FIFTH SEMESTER EXAMINATION JUNE-2025

(Branch : Mechanical Engineering)

ME-5302 MACHINE DESIGN - I

Time   :   Three Hours

*Maximum Marks : **70***
*Min. Pass Marks : **22***

Note : Attempt any five questions. Use of Design Data Book is permitted.

1(a) What do you understand by –   **04**

(i) Empirical design   (ii) Rational design   (iii) Adaptive design   (iv) Optimum design

(b) Explain in detail, what do you understand by morphology of design?   **10**

2   Write short notes on : (i) Different maintenance strategies   **14**
                                            (ii) Factor of safety and its importance in design
                                            (iii) Environmental consideration in design

3(a) What is Stress Concentration? Discuss causes and mitigation of stress concentration.   **07**

(b) Explain Rotating Mirror Beam method to determine endurance strength of a material.   **07**

4(a) Define : (i) Stress Ratio   (ii) Amplitude Ratio   (iii) Index of Sensitivity   **04**
               (iv) Fatigue Stress Concentration Factor.

(b) A steel cantilever is 200 mm long. It is subjected to an axial load which varies from 150 N   **10**
(compression) to 450 N (tension) and also a transverse load at its free end which varies
from 80 N up to 120 N down. The cantilever is of circular cross section. It is of diameter 2
d for first 50 mm and of diameter d for the remaining length. Determine its diameter using
factor of safety of 2. Assume the following values :

- Yield stress   : 330 MPa
- Endurance limit in reverse loading   : 300 MPa
- Correction factors   : $\begin{cases} 0.7 \text{ in reverse axial loading} \\ 1.0 \text{ in reverse bending} \end{cases}$
- Stress concentration factor   : $\begin{cases} 1.44 \text{ for bending} \\ 1.64 \text{ for axial loading} \end{cases}$

Size effect factor=0.85 , Surface effect factor=0.90, Notch sensitivity index = 0.90

5(a) A shaft supported at the ends in ball bearings carries a straight tooth spur gear at its mid   **07**
span and is to transmit 7.5 kW at 300 rpm. The pitch circle diameter of the gear is 150 mm.
the distances between the centre line of bearings and gear are 100 mm each. If the shaft is
made of steel and the allowable shear stress is 45 MPa, determine the diameter of the shaft.
The pressure angle of the gear may be taken as 20^0.

(b) Design a clamp coupling to transmit 30 kW at 100 rpm. Allowable shear stress for shaft   **07**
and key is 40 MPa and number of bolts connecting two halves is six. Permissible tensile
stress for bolt is 70 MPa. The coefficient of friction between muff and shaft may be taken
as 0.30.

6(a) Explain: (1) Nipping (2) Wahl's Stress Factor.   *04*

(b) Design a valve spring of a petrol engine for the following operating conditions: *10*

    (i)   Spring load when valve is open   : 400 N
    (ii) Spring load when valve is closed   : 250 N
    (iii) Maximum inside diameter of spring : 25 mm
    (iv) Length of the valve when valve is open   : 40 mm
    (v) Length of the valve when valve is closed : 50 mm
    (vi) Maximum permissible shear stress   : 400 MPa

7(a) Derive the expression of efficiency of square threaded screw and plot a graph of efficiency   *06*
against helix angle.

(b) A screw having a double square thread to raise a load of 100 kN at a speed of 1/ 60 m/s.   *08*
Use following data :

Pitch = 25 mm,   Outside Diameter of thread = 75 mm,   Mean collar Diameter = 127 mm,
Coefficient of friction for screw = 0.10,   Coefficient of friction for collar = 0.13.

Determine : (i) Power required to derive the screw
             (ii) Efficiency of the screw and the collar.

8(a) Give a brief classification of clutches. How the material for clutch is selected? What are   *04*
different materials in common use?

(b) A simple band brake operates on a drum of 600 mm in diameter that is running at 200 rpm.   *10*
The coefficient of friction is 0.25. The band brake has a contact angle of 270°C, one end is
fastened to a fixed pin and other end to the brake arm 125 mm from the fixed pin. The
straight brake arm is 750 mm long and placed perpendicular to the diameter that bisects the
angle of contact. What is the pull necessary on the end of the brake arm to stop the wheel,
if 35 kW is being absorbed? What is the direction for this minimum pull?

*****

B.Tech FIFTH SEMESTER EXAMINATION JUNE-2025

(Branch : Mechanical Engineering)

ME-5303 MACHINE TOOLS

Time   :   Three Hours

Maximum Marks   :   70
Min. Pass Marks   :   22

Note : Attempt any five questions. Each question carries equal marks.

1(a) What is cutting fluid and why is it used? Describe the different types of cutting fluids.   **07**

 (b) List and explain different materials used for cutting tools. What are the properties of an   **07** ideal cutting tool material?

2(a) List and explain the different wear mechanisms in single-point cutting tools.   **07**

 (b) What is tool signature and nomenclature of single point cutting tool? Explain with neat   **07** diagram.

3(a) Explain the different operations that can be performed on a lathe machine.   **07**

 (b) What are the main components of a lathe machine? Describe the function of each.   **07**

4(a) Describe the working principle of a grinding machine. Illustrate with a neat sketch.   **07**

 (b) Explain the significance of grain size, bond type and grade in grinding wheels. How do   **07** these factors affect the grinding process?

5(a) What do you understand by climb milling and conventional milling? How can you   **07** compare both milling processes?

 (b) Explain the process of cutting of gears in milling machine.   **07**

6(a) Describe important parts of drilling machine and their functions.   **07**

 (b) Describe working principle of broaching machine. Also list various types of broaching   **07** machine.

7(a) How the gears are manufactured by die-casting? Write down its advantages and   **07** limitations.

 (b) Why gear finishing is required? Name and explain gear finishing operations.   **07**

8(a) Explain the quick return mechanism used in shaper machine.   **07**

 (b) What do you mean by R.M.S. Value and C.L.A. Value method of average roughness   **07** assessment?

*****

B.Tech FIFTH SEMESTER EXAMINATION JUNE-2025

(Branch : Mechanical Engineering)

ME-5311 (EL-I) MEASURMENT SYSTEM & MECHATRONICS

Time : Three Hours

Maximum Marks : 70
Min. Pass Marks : 22

Note : Attempt any five questions. Each question carries equal marks.

1   Explain the following terms :   *14*

   (i)   Accuracy
   (ii)   Precision
   (iii) Static sensitivity
   (iv)   Linearity with suitable examples.

2   Write short notes on types of error in measurements and explain each type briefly.   *14*

3(a) Discuss the rotameter with neat sketch.   *07*

 (b) Discuss the one temperature measuring devices with neat sketch.   *07*

4   Discuss the various low pressure gauges with its merits and demerits.   *14*

5(a) Classify the electrical strain gauge and describe any one of them.   *07*

 (b) What are load cells? Discuss the working of hydraulic and pneumatic load cells with *07*
      suitable diagrams.

6(a) Describe the advantages and limitations of open and closed loop system.   *07*

 (b) Discuss the digital and analog systems with suitable examples.   *07*

7   Explain the various transducers in measurement system namely LVDT, piezoelectric *14*
    transducer.

8   Describe the various order system in measurement system with suitable example with *14*
    mathematical equation

*****

B.Tech FIFTH SEMESTER EXAMINATION JUNE-2025

(Branch : Mechanical Engineering)

EE-5351 (OEL-I) ELECTRICAL TECHONLOGY

Time : Three Hours

*Maximum Marks : **70***
*Min. Pass Marks : **22***

*Note : **Attempt any five questions. Each question carries equal marks.***

1(a) Explain the principle of operation of three-phase synchronous motor.   **07**

 (b) A 6-pole ac generator is running and producing the frequency of 60 Hz. Calculate the **07** revaluations per minute of generator. If the frequency is reduced to 20 Hz, how many number of poles will be required if the generator is to be run at the same speed.

2(a) Why synchronous motor is not self-starting? Explain in detail.   **07**

 (b) Explain the constructional features of synchronous motor.   **07**

3(a) A three-phase 50 Hz induction motor has a no-load speed of 900 rpm and a full load speed **07** of 860 rpm. Calculate :
    (i)   Number of pole
    (ii)   Slip at no-load
    (iii) Slip at full-load
    (iv)   Frequency of rotor current at no-noad
    (v)   Frequency of rotor current at no-noad.

 (b) Explain the working principle of a 3-phase induction motor.   **07**

4(a) Draw and explain the torque-slip characteristic of a typical induction motor.   **07**

 (b) Explain with neat diagrams of the capacitor run single-phase induction motor.   **07**

5(a) Explain the choice of motor for following : (i) Rolling mill   (ii) Textile mill.   **07**

 (b) Briefly describe the method of resistance type of electric furnace.   **07**

6(a) Explain the comparison between resistance and electric welding.   **07**

 (b) Explain the working principle of welding transformer.   **07**

7(a) Discuss the different types of tariffs.   **07**

 (b) Define the following : (i) Demand factor   (ii) Load factor   (iii) Maximum demand.   **07**

8(a) What are the factors for site selection of a hydro power station?   **07**

 (b) Explain the working principle of PNP transistor.   **07**

*****