Lib
05/05/2015

TE (Mech. Engg), Sem - VI, 5/5/15
Internal Combustion Engine

BHARATIYA VIDYA BHAVAN'S
SARDAR PATEL COLLEGE OF ENGINEERING
[An Autonomous Institution Affiliated to University of Mumbai]
END SEMISTER EXAMINATION, April 2015

SEM / CLASS: SEM VI / T. E. (MECH. ENGG.) **TOTAL MARKS: 100**

SUBJECT: INTERNAL COMBUSTION ENGINE **TIME: 03 HRS**

Master

Note: Question No. 1 is compulsory.
Attempt **any Four questions out of remaining six** questions.
Answers to all sub questions should be grouped together.
All questions carry equal marks.
Make suitable assumptions with proper explanations.

Q. 1. : Answer the following questions (any five)
(a) Discuss in detail the application of various types of I C Engines.
(b) What is meant by pumping loss? Discuss its effects on the engine performance.
(c) Define volumetric efficiency and discuss the effect of various factors affecting the volumetric efficiency.
(d) Explain with neat sketch wet sump lubrication system.
(e) What are the various desired properties of a lubricant and explain how additives help to achieve the desired properties.
(f) With a neat sketch explain forced circulation cooling system.

Q.2. (A) During the trial of a single cylinder, four stroke oil engine, the following data were recorded:
Bore = 20 cm; stroke = 40 cm; IMEP = 6 bar; brake torque = 407 Nm, Speed = 250 rpm; fuel consumption = 4 kg/h; calorific value of fuel = 43 MJ/kg; Cooling water flow rate = 4.5 kg/min; Air used per kg of fuel = 30kg, Rise in cooling water temperature = 45°C; temperature of exhaust gases = 420°C ambient temperature = 20°C; sp. heat of exhaust gases = 1kJ/kgK; sp. heat of water = 4.18 kJ/kgK.
Calculate 1. IP. 2. BP and 3. Heat balance sheet for the test in kJ/h.

(B) 1. Describe with a neat sketch the working principle of a crankcase scavenged two stroke petrol engine.
2. Explain the functions of an injection pump, governor, fuel injector and a nozzle in fuel injection system.

Q.3: (A) A four cylinder, four stroke diesel engine develops a power of 180 kW at 1500 rpm. BSFC is 0.2 kg/kWh. At the beginning, injection pressure is 30 bar and the maximum cylinder pressure is 50 bar. The injection is expected to be t 200 bar and maximum pressure at the injector is set to be about 500 bar. Assuming the following.
Coefficient of discharge for = 0.7, specific gravity of fuel = 0.875; atmospheric pressure = 1 bar;

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Internal combustion Engine,

Effective pressure difference = Average pressure difference over the injection period
Determine the total orifice area required per injector if the injection takes place over 15° crank angles.

(B) 1. How the distributor is designed according to firing order? Why the vacuum advance mechanism is necessary ignition system?

2. What is a two-stroke engine and how does it differ from four-stroke engine?

Q. 4: (A) A simple jet carburetor is required to supply 5 kg of air and 0.5 kg of fuel per minute. The fuel specific gravity is 0.750. The air is initially 1 bar and 300K. Calculate the throat diameter for a flow velocity of 100 m/s. Velocity coefficient is 0.8. If the pressure drop across the fuel metering orifice is 0.80 of that of the throat, calculate orifice diameter assuming coefficient of discharge for fuel = 0.60

(B) Describe with suitable sketches the combustion phenomenon in SI engines, and explain the different phases of combustion.

Q. 5: Answer the following questions (any five)
(A) Alternative fuels for IC engines
(B) Various methods of determining frictional power (FP)
(C) With a neat sketch explain the battery ignition system.
(D) With suitable sketch explain the different circuits of a Solex carburetor
(E) Discuss the important qualities of SI engine fuel
(F) Do I C Engines operate on a thermodynamic cycle? Draw the Otto cycle on PV and TS diagrams and mark the various processes.

Q. 6: (A) A four stroke oil engine of 3000 CC capacity develops 14 kw per m^3 of free air induced per minute. When running at 3500 rpm it has a volumetric efficiency of 70% referred to free air conditions of 27°C and 1.013 bar. It is proposed to boost the power of the engine by supercharging by a blower (driven mechanically from the engine) of pressure ratio 1.7 and isentropic efficiency of 75%. Assuming that at the end of induction the cylinders contain a volume of charge equal to the swept volume, at the pressure and temperature of the delivery from the blower, estimate the increase in BP to be expected from the engine. Take overall mechanical efficiency of the engine is 80%.

(B) State the application of C I engine. State the various factors which affect combustion in C I Engine. State the effect of the following engine parameters on engine friction:
1. Stroke to bore ratio 2. Piston rings 3 Compression ratio 4 Engine speed 5. Engine load

Q. 7: Answer the following questions
(A) Why overheating and overcooling of I C engines is harmful.
(B) Discuss the various scavenging systems.
(C) What is meant by heat balance of IC engine? What is the physical significance of heat balance?
(D) Mention the factors to be considered for the design of combustion chambers of the diesel engine.
(E) Differentiate between battery ignition and magneto ignition system.

TE(Mech), Sem - VI, Re. exam, 18/6/15 18/06/15
Internal Combustion Engine

BHARATIYA VIDYA BHAVAN'S

SARDAR PATEL COLLEGE OF ENGINEERING

[An Autonomous Institution Affiliated to University of Mumbai]

RE EXAMINATION; MAY 2015

SEM / CLASS: SEM VI / T. E. (MECH. ENGG.) **TOTAL MARKS: 100**

SUBJECT: INTERNAL COMBUSTION ENGINE **TIME: 03 HRS**

Note: Question No. 1 is compulsory.

Attempt **any Four questions out of remaining six** questions.

Answers to all sub questions should be grouped together.

All questions carry equal marks.

Make suitable assumptions with proper explanations.

Master

Q. 1. : Answer the following questions (any five)

(a) Discuss the important qualities of SI engine fuel.

(b) Explain the various factors that affect the process of carburetion. Briefly discuss the air-fuel ratio requirements of a petrol engine from no load to full load.

(c) Explain the functions of an injection pump. governor, fuel injector and a nozzle in fuel injection system.

(d) Mention the factors to be considered for the design of combustion chambers of the diesel engine.

(e) What is a two-stroke engine and how does it differ from four-stroke engine?

(f) How are I C Engines classified?

Q.2: (A) A simple jet carburetor is required to supply 5 Kg of air per minute and 0.3 Kg of fuel per minute of density 800 Kg/m^3. The air is initially at 1 bar and 27°C. Calculate the throat diameter of the choke for a flow velocity of 100 m/s. Velocity coefficient = 0.85. If the pressure drop across the fuel metering orifice is 0.80 of that of the choke, calculate orifice diameter assuming C_{df} = 0.60.

(B) Discuss the performance characteristics of SI and CI engines. Explain the uses of different types of test usually conducted on I C Engines?

Q. 3: (A) A Two-stroke diesel engine delivers 5000 kW while using 1000 kW to overcome friction losses. It consumes 2300 kg of fuel per hour at an air-fuel ratio of 20:1. The heating value of fuel is 42000 kJ/kg. Find the (a) IP, (b) mechanical efficiency, (c) air consumption per hour, (d) indicated thermal efficiency, and (e) brake thermal efficiency.

(B) Calculate the diameter of the injector orifice for the following data of a 6-cylinder, 4-stroke C I engine.

BP = 240 kW, N = 1300 RPM, BSFC 0.3 kg/kWh. cylinder pressure = 36 bar, injection pressure = 200 bar, specific gravity of fuel = 0.90. Coefficient of discharge of the fuel orifice = 0.92, period of injection = 36° of crank angle.

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Internal Combustion Engine

Q. 4: (A) The following data relate to the testing of a 4-stroke, 4-cylinder diesel engine: Bore = 36 cm, stroke = 40 cm, speed = 350 RPM, BP =257 kW, IMEP = 7 bar, fuel consumption = 72 kg/h, C.V. of fuel = 43960 kJ/kg. air consumption = 28.2 kg/min, mass of jacket cooling water = 86 kg/min, rise in temperature of jacket cooling water = 41°C, amount of piston cooling oil = 53 kg/min, temperature rise of cooling oil = 23°C, specific heat of cooling oil = 2.09 kJ/kg,K, room temperature = 20°C, exhaust gas temperature = 325°C, C_p of dry exhaust gas = 1.045 kJ/kgK, specific heat of water = 4.18 kJ/kg K.
Draw up the heat balance sheet on kW and percentage basis. Calculate indicated, brake thermal and mechanical efficiencies.

(B) With the help of suitable sketch, discuss the working principle of battery ignition system. Differentiate between battery ignition and magneto ignition system.

Q. 5: (A) By suitable sketches, show the various possible cylinder arrangement of I. C. Engine. What is the reason that the two stroke engines are not used in passenger cars?

(B) Discuss the properties of good lubricant. What are the basis for material selection for the design of cylinder, piston, crankshaft and camshaft?

Q. 6: (A) A 4-Stroke diesel engine is designed to operate with the following characteristic at sea level, where the mean conditions are 1.013 bar and 10°C;
BP =250kW, volumetric efficiency =78% (at sea level free air conditions), Sp. fuel consumption =0.245kg/kWh, A/F ratio =17, speed =1500 rpm.
Determine the required engine capacity and the BMEP.
If the engine is run at an altitude of 2700m where the atmospheric pressure is 0.72 bar by fitting a supercharger directly and mechanically coupled to the engine; the power consumed by the supercharger is 8% of total power produced by engine and temperature of air leaving the supercharger is 32°C. A/F ratio and thermal efficiency remain the same for the supercharged engine as when running un-supercharged at sea level, as does the volumetric efficiency.
Determine the increase of air pressure required at the supercharger to maintain the same net output of 250kW.

(B) What is Willian's line method? To which type of engine it is applicable? What is the accuracy of this method? Discuss Morse Test. What do you mean by heat balance of an I. C. Engines?

Q.7. Write short note on following (any five)

(A) Properties of good lubricant
(B) Compare the main properties of SI and CI engines fuels
(C) Various methods of determining frictional power (FP)
(D) Solex carburetor with neat sketch with fuel circuit
(E) Working principle of four stoke petrol engine
(F) Alternatives fuels for IC engine
(G) Wankel engines

TE (Mech), Sem-VI,
Refrigeration and air conditioning.

lib
27/04/15

BHARTIYA VIDYA BHAVAN'S

SARDAR PATEL COLLEGE OF ENGINEERING

[An Autonomous Institution Affiliated to University of Mumbai]

MUNSHI NAGAR, ANDHERI(WEST), MUMBAI-400 058

END SEMESTER

CLASS:**T.E(Mech)** SEM: **VI**

SUBJECT: **REFRIGERATION AND AIR CONDITIONING**

Academic Year: **2014-15**

TOTAL MARKS:**100**

DURATION: **3 HOUR**

DATE: **27/04/2015**

1. Question number **ONE** is compulsory.
2. Answer any **FOUR** questions out of remaining **SIX** questions.
3. Assume suitable data and justify the same.
4. Use of refrigeration tables, steam table and phychrometric chart is permitted.

Master

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1 Solve questions given below. **[20]**

a) Define 1 ton of refrigeration and show that it is equal to 3.51 kW.

b) In a vapour-absorption refrigeration system, the refrigeration temperature is -10°C. The generator is operated by solar heat where the temperature is reached 100°C. The temperature of heat sink is 45°C. What is the maximum possible COP of the system?

c) Compare primary refrigerants and secondary refrigerants

d) Define terms: (i) Humidity ratio (ii) Relative Humidity (iii) Degree of saturation (iv) Dew point temperature

e) Explain human comfort and comfort chart.

2.(a) An R-134a simple saturation cycle refrigerator operates at 40°C condenser and -16°C evaporator temperatures. Determine COP and HP/TR. If a liquid –vapour regenerative heat exchanger is installed in the system, with the suction vapour at 15°C, calculate the change in COP and HP/TR. **[12]**

(b) Explain actual vapour compression cycle by using p-v and T-s diagram explaining all heat gains and pressure losses. **[08]**

3. (a) A regenerative aircraft refrigeration system is employed in an aircraft flying at a speed of 1500 km/hr. The ambient conditions are 0.1 bar and -63°C. The ideal pressure recovery factor is 0.92. The pressure ratio in main compressor is 5. The air bled off from the main compressor is first cooled in the air cooler with a cooling ratio of 0.6. In regenerative heat exchanger air is further cooled to a temperature of 30°C by chilled air from the exit. A temperature of this cooling air which is bypassed is 92°C. The remaining air from the cooling turbine exit goes to the cabin. The isentropic efficiency of compressor and turbine is 90% and 80% respectively. The cooling turbine drives the cooling air fan which draws in the cooling ram air discharge from the air

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Refrigeration & Air Conditing

cooler. The cabin is to be maintained at 1.01 bar and 27°C. Find (i) The mass of air bypassed for cooling purposes in regenerative heat exchanger in kg/min. Take tonnage capacity 30 TR. (ii) Mass of bleed off air in kg/min. (iii) COP of the unit excluding the power required in ram compression. **[12]**

(b) Explain designation system of refrigerants in detail. **[08]**

4.(a) Explain all desirable properties of refrigerants in detail. **[10]**

(b) Explain what Effective temperature is and also explain purpose of ventilation air in air-conditioning. **[10]**

5.(a) A sample of moist air is at 30°C DBT and 20°C WBT. If barometer pressure is 740 mm of Hg. Calculate for sample of air without using psychrometric chart. (i) Relative humidity (ii) Humidity ratio (iii) Dew point temperature (iv) Density and (v) Enthalpy **[10]**

(b) Explain various methods of duct design **[10]**

6. A building has the following calculated cooling loads: **[20]**

Room sensible heat gain = 310 kW

Room latent heat gain = 100 kW

The space is maintained at DBT of 25°C and relative humidity of 50 %. The outdoor air is at 38°C and 50% R.H. And 10 % by mass of air supplied to the building is outdoor air. If the air supplied to the space is not at temperature lower than 18°C. Find (i) Minimum amount of air supplied to space in m^3/s. (ii) Volume flow rates of return air and outdoor air (iii) State and volume flow rate of air entering the cooling coil. (iv) Capacity, ADP, BPF and SHF of the cooling coil.

7. (a) Explain working of practical single effect water-lithium bromide absorption chiller with neat sketch. **[10]**

(b) Explain working of Electrolux refrigerator with neat sketch. **[10]**

TE (mech), Sem - VI, Re-exam, 15/6/15 Lib 15/06/15
Refrigeration & Air Conditioning.

BHARTIYA VIDYA BHAVAN'S

SARDAR PATEL COLLEGE OF ENGINEERING

[An Autonomous Institution Affiliated to University of Mumbai]

MUNSHI NAGAR, ANDHERI(WEST), MUMBAI-400 058

Re-Examination June 2015

CLASS/SEM: **T.E(Mech)/VI** TOTAL MARKS:**100**

SUBJECT: **REFRIGERATION AND AIR CONDITIONING** DURATION:**3 HOURS**

1. Answer any **Five** questions out of **Seven** questions.
2. Figures to the right indicate full marks.
3. Assume suitable data and justify the same.
4. Use of refrigeration tables, steam table and phychrometric chart is permitted.

Master

Q.1(a) What are the modifications done in the ideal reversed Carnot cycle so that it can be used as practical cycle for refrigeration. [05]

(b) Discuss the advantages of using air as refrigerant in Aircraft refrigeration system. [05]

(c) Discuss the primary and secondary refrigerants with few examples in each case. [05]

(d) Explain comfort chart. [05]

Q.2(a) An ammonia refrigeration machine has working temperatures of 35°C in the condenser and -15 C in the evaporator. For dry compression and wet compression calculate following quantities for both cases.

(i) Theoretical piston displacement per ton refrigeration.

(ii) Theoretical horsepower per ton refrigeration and

(iii) Coefficient of performance. [12]

(b) Explain what is the effect of condenser pressure, suction vapour superheat and liquid subcooling on the performance of vapour compression refrigeration system. [08]

Q.3(a) Explain complete designation system of all refrigerants [10]

(b) What is the term ODP and GWP? Discuss it in detail and also discuss substitute of R-12 [10]

Q.4(a) Define the terms (i) Spacific humidity (ii) Dew point temperature (iii) Degree of saturation (iv) Relative humidity (v) Wet bulb temperature. [10]

(b) Calculate (i) relative humidity, (ii) humidity ratio, (iii) dew point temperature, (iv) density and (v) enthalpy of atmospheric air when the DBT is 35°C, WBT is 23°C and the barometer reads 750 mm Hg. [10]

TE (Mech), Sem - VI, 15/6/15, Re-Exam
Refrigeration & Air Conditioning

Q.5 (a) Explain different duct design methods [10]

(b) Define the term "Effective Temperature" and explain its importance in air conditioning system. Describe factors which affect effective temperature. [10]

Q.6 The following data was collected to design an air-conditioning system for restaurant:

Outside conditions ----- 34°C DBT and 28°C WBT
Inside design conditions --- 24°C DBT and 50% RH
Solar heat gain through walls, roof and floor ----- 4.5 kW.
Solar heat gain through glass ------ 4.21 kW
Occupants -------25
Latent heat gain per person ---- 100 watts
Sensible heat gain per person----- 83 watts
Internal lighting load -------- 15 lamps of 100 watts capacity each and 10 florescent tubes of 80 Watts each.
Sensible heat gain from other sources ------11.1 kW
Infiltrated air ------ 14 m^3/min

If 40% fresh air and 60% re-circulated air are mixed and passed through the conditioner coil then find the followings. Assume bypass factor of the coil 0.35.

(i) Amount of total air in m^3/min.
(ii) Dew-point temperature of the coil.
(iii) The condition of supply air to the room.
(iv) The capacity of the conditioner in tons of refrigeration. [20]

Q.7 (a) Explain with neat sketch the working of three fluid refrigerator. [10]
(b) Explain boot-strap aircraft refrigeration system with schematic and T-s diagram. [10]

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Machine Design-I

Bharatiya Vidya Bhavan's

SARDAR PATEL COLLEGE OF ENGINEERING

(An Autonomous Institution Affiliated to University of Mumbai)

First Half 2015

Total Marks : 100 — Duration : 3 Hours

CLASS/SEM T.E (MECH). VI Sem. — SUBJECT : Machine Design I

- Attempt any **FIVE** question out of **SEVEN** questions
- Answers to all sub questions should be grouped together
- Figures to the right indicate full marks
- Use of PSG Data Book is permitted.
- Assume suitable data where ever necessary.

Master

Q.1 Explain :-

a) I.S. Codes
b) Fatigue Failure.
c) Soderberg and Goodman design criteria.
d) Selection of fits.

(20)

Q.2 A screw threaded power screw has a nominal diameter of 30 mm and a pitch of 6mm with double threads. The load on the screw is 6 KN and the mean diameter of the thrust collar is 40 mm. The coefficient of friction for the screw is 0.1 and the collar is 0.09. Determine,

(i) Torque required to raise the screw against the load.
(ii) Torque required to lower the screw with the load
(iii) Overall efficiency
(iv) Is the screw self locking ?

(20)

Q.3 (a) A spherical pressure vessel, with 500 mm inner diameter, is welded from steel plates. The welded joints are sufficiently strong and do not weaken the vessel. The plates are made from cold drawn steel 20C8 (Sut = 440 N/mm^2 and Syt = 242 N/mm^2). The vessel is subjected to internal pressure, which varies from 0 to 6 N/mm^2. The expected reliability is 50 % and factor of safety is 3.5. The vessel is expected to withstand infinite number of stress cycles. Calculate the thickness of the plates.

(10)

Q.3 (b) A mass of 50 kg drops through 25 mm at the centre of a 250 mm long simply supported beam. The beam has square cross section. It is made of steel 30C8 (Syt = 400 N/mm^2) and the factor of safety is 2. The modulus of elasticity is 207 000 N/ mm^2. Determine the dimensions of the cross section of the beam.

(10)

Q.4 A horizontal piece of commercial shafting is supported by two bearings 1.5 m apart. A keyed gear 20 degree involute and 175 mm in diameter is located 400 mm to the left of the right bearing and is driven by the gear directly behind it. A 600 mm diameter pulley is keyed to the shaft 600 mm to the right of left bearing and drives a pulley with a horizontal belt directly behind it. The tension ratio of the belt is 3 to 1 , with the slack side on top. The drive transmits 45 KW at 330 rpm. Take Kb = Kt = 1.5. Calculate the necessary diameter of the shaft and the angular deflection in degrees. Use allowable shear stress 40 MPa and G = 80 x 10^9 N/mm^2.

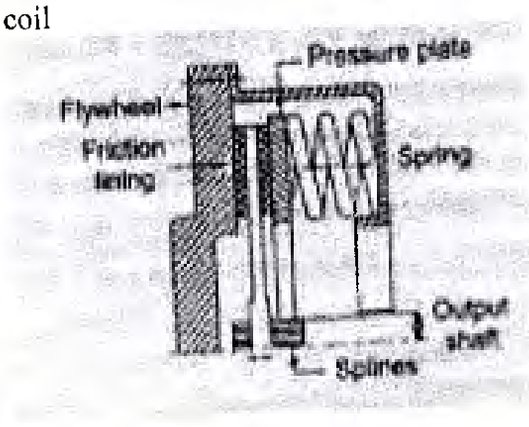
(20)

TE (Mech), Sem- VI, Re-Exam, 16/6/15

Machine Design - I

Q.5 An automotive single plate clutch consists of two plates of friction surfaces, one between the friction lining and the pressure plate and the other between the friction lining and the flywheel, as shown in figure. Eight identical helical compression springs, arranged in parallel, provide the required axial thrust on the friction surface. The total spring force exerted by all springs is 2400 N and the corresponding deflection of each spring is approximately 15 mm. The spring index can be taken as 8. The spring are made of patented and cold drawn steel wire with ultimate tensile strength of 1390 N/mm^2 and modulus of rigidity of 81370 N/mm^2. The permissible shear stress for the spring wire can be taken as 30 % of ultimate tensile strength. Design the spring and calculate :

1. wire diameter
2. Mean coil diameter
3. Number of active coils
4. Total number of coils
5. Solid length
6. Free length
7. Pitch of the coil



Clutch Mechanism

(20)

Q.6 (a) A shaft which rotates at a constant speed of 160 rpm is connected by belting to a parallel shaft 72 cm apart which has to run at 60, 80 and 100 rpm. The smallest pulley on the driver shaft is 4 cm in radius. Determine the remaining radii of the two stepped pulleys for (a) a crossed belt (b) an open belt. Neglect belt thickness and slip. (10)

Q6. (b) Power is transmitted by using a V- belt drive. The included angle of V groove is 30°. The belt is 20 mm deep and its maximum width is 20 mm. If the mass of the belt is 0.35 kg/m length and the maximum allowable stress is 1.4 MPa. Determine the maximum power transmitted when the angle of lap is 140° and $\mu = 0.15$. (10)

Q7 (a) A wall bracket is attached to a wall by means of four identical bolts, two at A and two at B , as shown in figure. Assuming that the bracket is held against the wall and prevented from tipping about point C by all four bolts and using an allowable tensile stress in the bolts as 35 N/mm^2, determine the size of the bolts on the basis of maximum principal stress theory.

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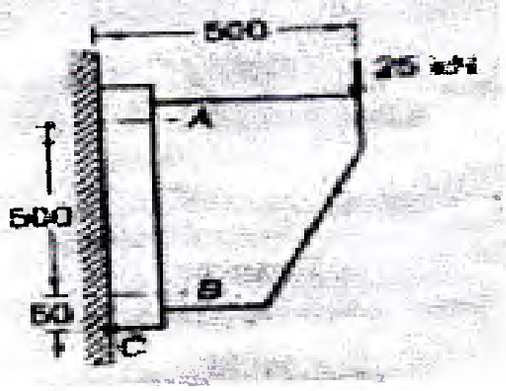
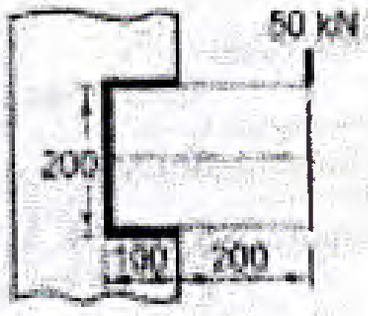
Machine Design - I



(10)

Q7 (b) A welded connection of steel plates is shown in figure. It is subjected to an eccentric force of 50 KN. Determine the size of the load, if the permissible shear stress in the weld is not to exceed 70 N/mm ^{2} .



(10)

TE (Mech), Sem - VI,
Machine Design - I

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29-4-15

Bharatiya Vidya Bhavan's

SARDAR PATEL COLLEGE OF ENGINEERING

(An Autonomous Institution Affiliated to University of Mumbai)

First Half 2015

Duration : 3 Hours

Total Marks : 100

SUBJECT : Machine Design I

CLASS/SEM : T.E (MECH)/VI Sem.

- Attempt any **FIVE** question out of **SEVEN** questions
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- Assume suitable data where ever necessary.

Master

Q.1 a) Design a socket and spigot type cotter joint to sustain an axial load of 100 KN. The material selected for the joint has the following design stresses. $\sigma t = 100$ N/mm^2, $\sigma c = 150$ N/mm^2 and $\tau = 60$ N/mm^2. (15)

b) (i) Explain kennedy key and Barth key.

(ii) Explain pin type flexible coupling. (05)

Q.2 a) A cantilever beam made of cold drawn carbon steel of circular cross-section as shown in figure is subjected to a load which varies from – F to 3F. Determine the maximum load that is member can withstand for an indefinite life using a factor of safety as 2. The theoretical stress concentration factor is 1.42 and the notch sensitivity is 0.9. Assume the following values :

Ultimate stress = 550 MPa

Yield stress = 470 Mpa

Endurance limit = 275 Mpa

Size factor = 0.85

Surface finish factor = 0.89 (10)

Q.2 b) A mass of 50 kg drops through 25 mm at the centre of a 250 mm long simply supported beam. The beam has square cross section. It is made of steel 30C8 (Syt = 400 N/mm2) and the factor of safety is 2. The modulus of elasticity is 207 000 N/ mm2. Determine the dimensions of the cross section of the beam.

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Machine Design - I

(10)

Q.3 A transmission shaft, supporting two pulleys A and B and mounted between two bearings C1 and C2 as shown in figure. Power is transmitted from pulley A to B. The shaft is made of plain carbon steel 45C8 (Sut=600 and Syt=380 N/mm2). The pulley are keyed to the shaft.Determine the shaft diameter using ASME code if, Kb = 1.5 and Kt = 1.0

Also determine the shaft diameter on the basis of torsional rigidity , if the permissible angle of twist between two pulleys is 0.5 degree and the modulus of rigidity is 79300 N/mm2.

(20)

Q.4 (a) A semi elliptical laminated spring is to carry a load of 5000 N and consist of 8 leaves 46 mm wide, two of the leaves being full length. The spring is to be made 1000 mm between the eyes and is held at the centre by a 60 mm wide band. Assume that the spring is initially stressed so as to induce an equal stress of 500 N/mm^2 when fully loaded. Design the spring giving :-

(i) Thickness of the leaves

(ii) Eye diameter

(iii) Length of the leaves

(iv) Maximum deflection and camber.

Assume E = 2.1 x 10^5 N/mm^2.

(10)

Q.4 (b) Design a compression helical spring to carry a load of 500 N with a deflection of 25 mm. The spring index may be taken as 8. Assume the following values for the spring material:

Permissible shear stress = 350 MPa

Modulus of rigidity = 84 KN/ mm^2

Wahls Factor = $\frac{4C-1}{4C-4} + \frac{0.615}{C}$, where C = Spring Index

(10)

Q.5(a) The diameter of small pulley of the belt drive is 250 mm and rotates at 900 rpm. The centre distance is 2.5 m. If the larger pulley rotates at 300 rpm, determine the diameter of larger pulley. Also find the belt angle of contact on both pulleys and length of the belt for open belt and cross belt arrangement.

(10)

Q.5(b) Power is transmitted by using a V- belt drive. The included angle of V groove is 30°. The belt is 2 cm deep and its maximum width is 2 cm. If the mass of the belt is 0.03434 N/cm length and the maximum allowable stress is 137.34 N/cm^2. Determine the maximum power transmitted when the angle of lap is 140° and μ = 0.15.

(10)

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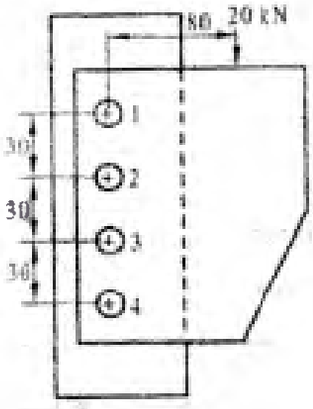
Machine Design - I

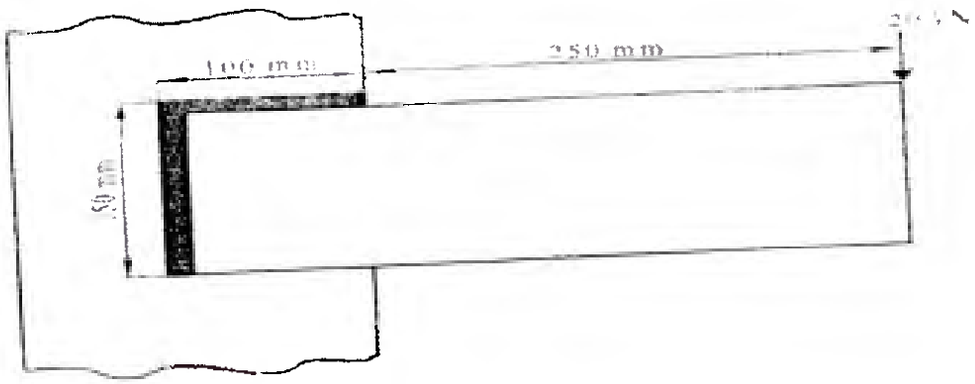
Q.6 (a) A bracket is supported by means of 4 rivets of same size as shown in figure. Determine the diameter of the rivet if the maximum shear stress is 140 N/mm^2.



All the dimensions are in mm.

(10)

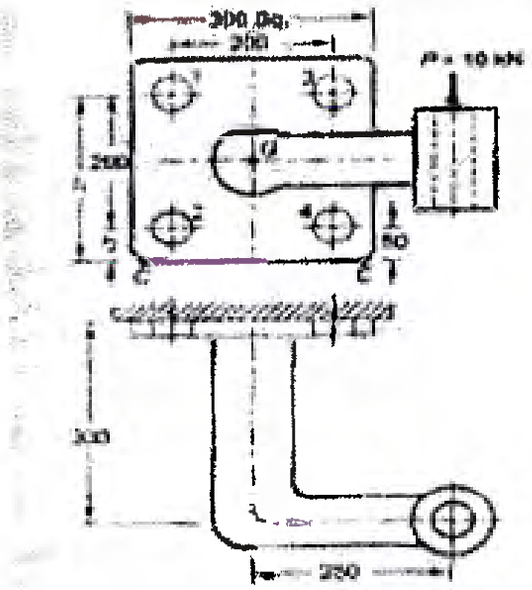
Q.6 (b) A 16 mm thick plate is welded to a vertical support by two fillet welds as shown in figure. Determine the size of the weld, if the permissible shear stress for the weld material is 75 MPa.



(10)

Q.7 (a) A rigid bracket subjected to a vertical force of 10 KN is shown in figure. It is fastened to a vertical stanchion by means of four identical bolts. Determine the size of the bolts by maximum shear stress theory. The maximum permissible shear stress theory in any bolt is limited to 50 N/mm2.

TE (Mech), Sem-VI, 2914115
Machine Design-I



(10)

Q7 (b) (i) Explain aesthetic and ergonomic considerations in design.

(ii) What is stress concentration? What are the methods to reduce that?

(10)

TE (Mech), Sem- VI, Re-exam 17/06/15 — Mechanical Vibration

Bhartiya Vidya Bhavan's

SARDAR PATEL COLLEGE OF ENGINEERING

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Total marks : 100 **Exam , June 2015 Re-exam**

CLASS/SEM : TE (Mech) / SEM- VI SUBJECT: **Mechanical Vibration**

- **Question No. 1 Compulsory**
- Solve any **Four** out of **Six** questions of remaining
- Assume suitable Data whenever necessary
- Figures to the right indicate full marks

Master

Q.1 Solve any **FOUR** **20**

a) Explain Classification of vibration

b) Explain different Types of damping

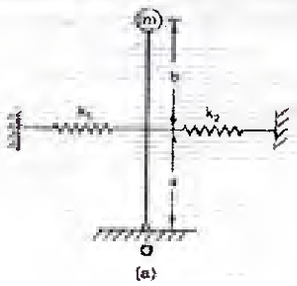
c) Explain Newtons method for equation of motion

d) Explain Matrix method for multy degree of freedom system

e) Explain Dunkerly's method with example

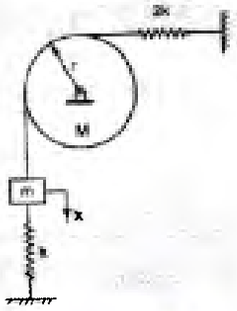
f) Explain Principle of Seismic Instrument

Q.2 a) i)Determine the expression for natural frequency of the system shown in fig. for small amplitude of vibration **10**
ii) If m, k_1, k_2, a, b are fixed, specify the value of 'a' for which system will not vibrate
iii)Find out the maximum acceleration of the mass
iv) what would be the natural frequency of the system if system were taken to moon where acceleration due to gravity is $1/6^{th}$ of that on the earth ?



(a)

b) Determine the natural frequency of the system shown in Fig. Using Energy method. **10**



TE (Mech), Sem-VI, Re-exam. 17/6/15

Mechanical Vibration

Q.3 a) A spring-mass-damper system is defined by following parameters m=3kg,k=100N/m,c=3 Ns/m.Determine :a)Determine Critical damping b) Damping ratio c) Frequency of damped oscillation d) Logarithmic decrement e) No.of cycles after which the initial amplitude is reduced to 20% **10**

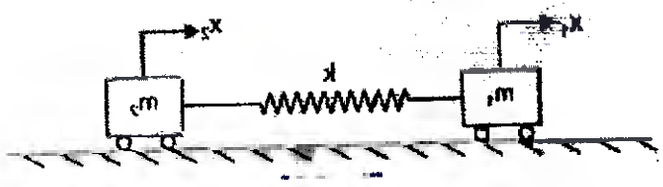
b) A mass of 10 kg is supported on spring which deflect by 2cm under the dead weight of the mass.The vibrations of the system are constrained to be linear and vertical and are damped by a dashpot which reduces the amplitude to one-quarter of its original value in two complete oscillations.Determine **10**

a) Damping force at unit speed
b) Time period of damped vibrations

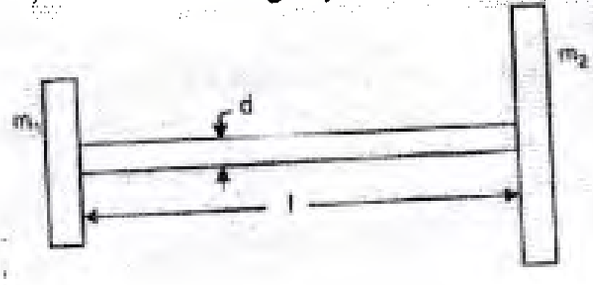
Q.4 a) An electric motor of mass 100 kg is mounted on elastic foundation having stiffness of $2x10^6$ N/m.When the motor is operated at 1450 rpm, it is subjected to a harmonic force of magnitude 1500 N. If the steady state amplitude of the motor is observed as 2 mm at the operating speed, determine the damping ratio of the foundation. **10**

b) Find out the frequency ratio for which amplitude in forced vibration will be maximum.Also determine the peak amplitude and the corresponding phase angle. **10**

Q.5 a) Determine the natural frequencies and amplitude ratios for the system shown in fig. It is given that m_1=20 kg, m_2=35 kg and k=300N/m **10**



b) Determine the natural frequency of torsional vibration of shaft with two circular discs at the two ends as shown in fig.Given that mass of discs, m_1=600kg,m_2=1000 kg, Diameter of the discs, d_1=1.5 m, d_2=2 m , length of shaft, l=0.3 m, diameter of the shaft, d=0.1 m, and modulus of rigidity of shaft material, G=$0.83x10^{11}$ N/m^2. **10**



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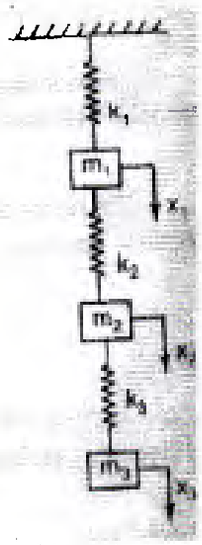
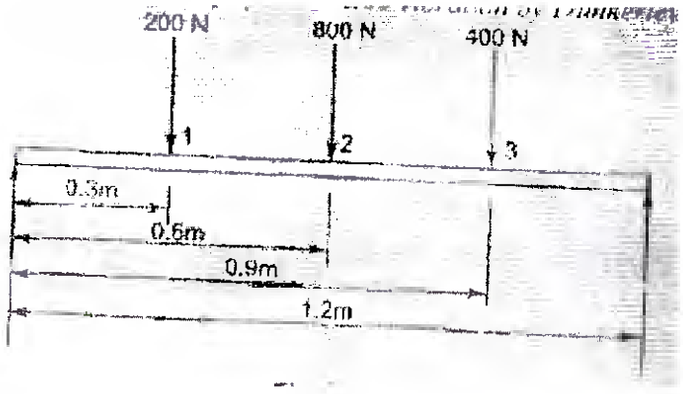
Mechanical Vibration

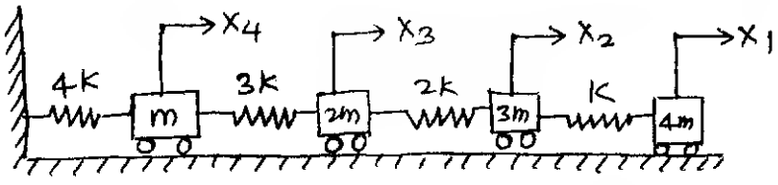
Q.6 a) Find the natural frequencies and mode shapes of 3 d.o.f. system shown in fig using matrix method **10**



Q6 b) A beam of negligible weight and length 1.2m is simply supported at the ends and carries three transverse loads of 200N,800N and 400N at a distance of 0.3m 0.6m and 0.9m from the left support.Find the frequency of transverse vibration by Dunkerley method. **10**



Q.7 a) Using Holzer method, determine the natural frequencies of the system shown in fig. Take m=1,k=1 **10**



b) Using Rayleigh method, find out the first natural frequency of transverse vibration of a uniform simply supported beam. **10**

T.E. (Mech) / Sem-VI
Mechanical Vibration.

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SARDAR PATEL COLLEGE OF ENGINEERING

(An Autonomous Institution Affiliated to University of Mumbai)

Total marks : 100 **Exam , May 2015**

CLASS/SEM : TE (Mech) / SEM- VI SUBJECT: **Mechanical Vibration**

- **Question No. 1 Compulsory**
- Solve any **Four** out of **Six** questions of remaining
- Assume suitable Data whenever necessary
- Figures to the right indicate full marks

MASTER FILE.

Q.1 Solve any **FOUR** 20

a) Explain detail steps involved in Vibration analysis

b) Explain different Types of Vibration

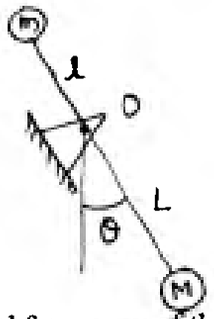
c) Explain Magnification Factor v/s Frequency Ratio and Phase angle Plot v/s Frequency Ratio

d) Explain Geared System with equivalent stiffness & equivalent polar mass moment of Inertia

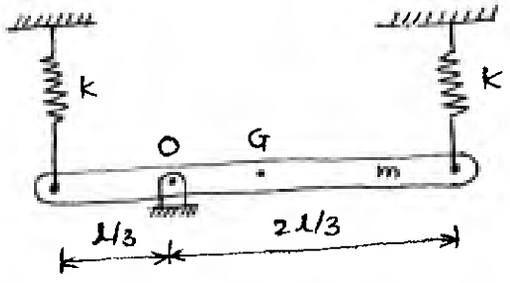
e) Explain Rayleigh Method for point loads and distributed mass m

f) Explain Vibration Isolation and suitable material used

Q.2 a) Find the natural frequency for small angular displacement of a pendulum pivoted at O and having two masses m and M connected at the opposite ends of the weightless rod as shown in fig 1(Use D'Alembert Principle) 10



b) Determine the natural frequency of the system shown in fig 2. The slender bar of mass m is pivoted at O and two springs having same stiffness K are connected at its two ends as shown Fig 2 (Use Energy Method) 10



T.E.(Mech) / Sem VI

Mechanical Vibration.

Q.3 a) Find out the frequency ratio for which amplitude in forced vibration will be maximum. Also determine the peak amplitude and the corresponding phase angle. 10

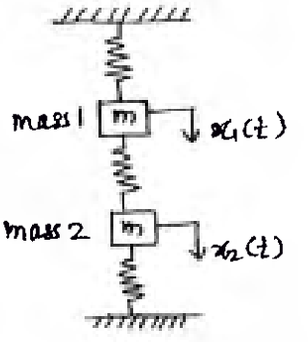
b) Explain different vibration measuring instruments 05

c) Explain different types of Vibration Force acting on the system and explain different systems where such force act. 05

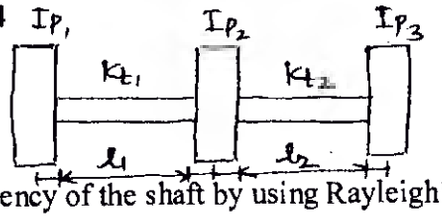
Q.4 a) Obtain the expression for MDOF system for Torsional Vibration branched system using Transfer Matrix method . 10

b) An engine mounted on elastic foundation having mass 100kg observed steady state displacement 5 mm occurred at frequency 300 rpm when harmonic force of 100 N is applied . Obtain damping constant and equivalent stiffness of the foundation 10

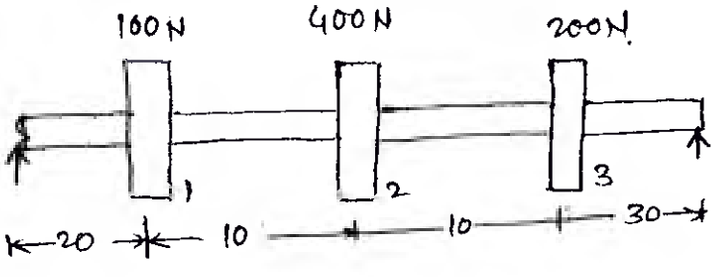
Q.5 a) Determine the natural frequency and normal modes for the system as shown in fig3.Draw the mode shape and locate the node. 10



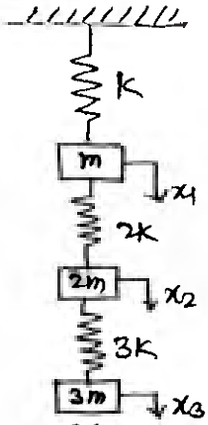
b) Obtain natural frequencies and Mode shapes with node position of THREE ROTOR system. Fig 4 10



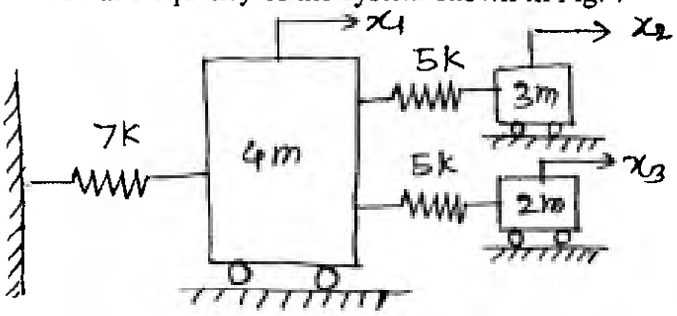
Q.6 a) Find the natural frequency of the shaft by using Rayleigh's method as shown in fig 5 10



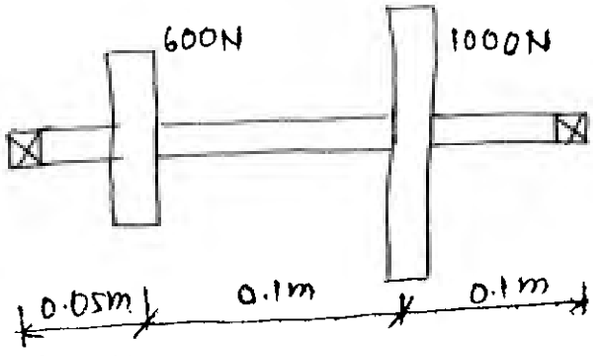
Q6 b) Determine the natural frequencies of the system shown in Fig 6 using matrix method 10



Q.7 a) Find the fundamental frequency of the system shown in Fig. 7 05



b) A steel shaft of uniform diameter ,simply supported at the ends carry two discs of weights 600N and 1000N as shown in fig 8 . Determine the fundamental natural frequency using Dunkerley method. Take E=196x 10^9 N/ m^2 and I= 4x10^{-7} m^4 05



c) Explain Holzer Method with suitable example 10

—— x o x —— x o x ——

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Manufacturing Planning and Control

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SARDAR PATEL COLLEGE OF ENGINEERING

(An Autonomous Institution Affiliated to University of Mumbai)

Re-exam
Total Marks : 100
Class/Sem : T.E / Mech, Sem VI

May 2015
Duration : 3 Hours
Subject : Manufacturing Planning and Control

- Question Number 1 is compulsory.
- Attempt any Four question out of remaining questions.
- Answers to all sub questions must be grouped together.
- Figures to the right indicate full marks
- Assume suitable data wherever required.

Master

Q1. Solve any four of the following. **[20]**

A. State the benefits of MPC to stakeholders
B. State and explain the factors favoring over capacity planning.
C. State the salient features of the MPS
D. Explain the seven waste as per the JIT with examples.
E. Steps of Monte Carlo simulation

Q2A. Explain the functions of MPC with suitable Diagram. **[10]**
Q2B. Explain the factors affecting JIT implementation. **[10]**

Q3A. What do you mean by Simulation? Why the simulation is needed? State the salient features of Monte Carlo simulation. **[10]**
Q3B. State and explain the ways to reduce the total inventory costs. **[10]**

Q4A. What is capacity planning? Why it is needed? How to plan the capacity? Draw the flow chart necessary to be used while planning capacity. State the factors favoring under capacity planning. **[10]**

Q4B. The air-conditioner manufacturing company has following demand pattern for last 10 years. Compute the demand for next 3 years using LSM. **[10]**

Year	Y1	Y2	Y3	Y4	Y5	Y6	Y7	Y8	Y9	Y10
Sales [000]	30	33	37	39	42	46	48	50	55	58

Q5A. A firm has developed MPS for 5 weeks for its products P and Q as shown below. **[10]**

Product	MPS for 5 weeks Quantity to be produced per week				
	1	2	3	4	5
P	-	60	60	60	-
Q	-	70	-	70	70

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Manufacturing planning and control

- Determine whether the above MPS under-loads or overloads the final assembly line that produces products P and Q. The final assembly line has an available capacity of 200 hours each. Each product P requires 2 hours and Each product Q requires 3 hours of final assembly capacity.
- Compute the actual final assembly capacity required to produce the MPS for both products. Compare the load with the final assembly capacity available in each week and for the total 5 weeks.
- Does sufficient final assembly capacity exists to produce the MPS?
- What changes to the MPS would you recommend?

Q5B. A materials manager Mr. A adopts the policy to place an order for a minimum quantity of 500 of a components to avail the discount of 10 %. It was found from the company records that for last year 8 orders were placed each of size 200. Ordering cost is Rs.500 per order. Inventory carrying charges are 40 % of unit price. Cost per unit is Rs.400. Is the material manager Mr. A justified in his decision? What is the effect of his decision on company? **[10]**

Q6A. Two major parts P1 and P2 for product require processing through six machine centre. The technological sequence of the parts on six machines and manufacturing times on each machine are

	Machine sequence	C	A	E	F	D	B
PART 1	Time (hrs):	2	3	4	5	6	1
	Machine sequence	B	A	E	F	C	D
PART 2	Time (hrs):	3	2	5	3	2	3

What would be the optimal scheduling for processing two parts? Find also the Total Elapsed time. For each machine specify the job that should be done first. Use graphical method. Attach the graph paper at the page of solution. **[10]**

Q6B. Construct the network diagram for the project comprising of activities B,C,E, F,G,H,I,J, L,M,N,P,Q such that the following precedence relationship are satisfied:

B<E,F; C,F, < G;C < L; E,G < H; H,L < I ; H<J; L <M; H,M <N; I,J <P;N <Q **[10]**

Q7A. Timber Ltd has two products Sofa and Chair. To produce one unit of Sofa, 2 units of material X and 4 units of material Y are required. To produce one unit of Chair, 3 units of material X and 2 units of material Y are required. As the raw material is in short supply not more than 16 units of each material can be used. The cost per unit of material X and material Y are Rs. 2.50 and Rs. 0.25 respectively. At least 2 units of sofa must be produced and sold. You are required:

A] to formulate mathematical model

B] to solve it for minimum cost (Graphically). **[10]**

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Manufacturing Planning and Control.

Q7B. Derive an expression for Production Model of Inventory. State the assumptions. Draw the suitable diagram. Illustrate it with suitable example. **[10]**

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Best of Luck!

TE(Mech), Sem - VI, 8/5/15 HD 08/05/15
Manufacturing Planning & Control

Bharatiya Vidya Bhavan's

SARDAR PATEL COLLEGE OF ENGINEERING

(An Autonomous Institution Affiliated to University of Mumbai)

May 2015

Total Marks : 100 Duration : 3 Hours

Class/Sem : T.E., Mech/Sem VI Subject : Manufacturing Planning and Control

- Question Number 1 is compulsory.
- Attempt any Four questionsout of remaining questions.
- Answers to all sub questions must be grouped together.
- Figures to the right indicate full marks
- Assume suitable data wherever required.

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Q1A. Explain the functions of MPC with suitable Diagram. **[10]**

Q1B. The air-conditioner manufacturing company has following demand pattern for last 10 years. Compute the demand for next 3 years using LSM. **[10]**

Year	Y1	Y2	Y3	Y4	Y5	Y6	Y7	Y8	Y9	Y10
Sales [000]	30	33	37	39	42	46	48	50	55	58

Q2A. The following information is available regarding the product.
Regular time production capacity =2500 units per month
Overtime production cost =Rs 10 per unit
Inventory carrying costs =Rs 3 per unit per month
Backlog costs = Rs 5 per unit per month
Beginning inventory = 400 units.
Demand in units for four months is 4000,3500,2500 and 2800 respectively.
Develop a level output capacity plan that yield zero inventory at the end of the 4th month. What is the total cost that will result from this plan? **[10]**

Q2B. A firm has developed MPS for 5 weeks for its products P and Q as shown below. **[10]**

Product	MPS for 5 weeks Quantity to be produced per week				
	1	2	3	4	5
P	-	60	60	60	-
Q	-	70	-	70	70

- Determine whether the above MPS under-loads or overloads the final assembly line that produces products P and Q. The final assembly line has an available capacity of 200 hours each. Each product P requires 2 hours and Each product Q requires 3 hours of final assembly capacity.

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- Compute the actual final assembly capacity required to produce the MPS for both products. Compare the load with the final assembly capacity available in each week and for the total 5 weeks.
- Does sufficient final assembly capacity exists to produce the MPS?
- What changes to the MPS would you recommend?

Q3A. A Company consumes 12000 units of a particular item. The company has a production capacity of 60 units /day The cost of each unit produced is Rs 8 The set up and tooling cost is Rs.96/set up. The carrying charges are 15% of unit cost/annum. The working days of the company per annum are 300. Find EBQ, Number of production run per year, Time in days between two production run, Annual Set up cost, Consumption rate, Total cost of inventory per annum. **[10]**

Q3B. A materials manager Mr. A adopts the policy to place an order for a minimum quantity of 500 of a components to avail the discount of 10 % . It was found from the company records that for last year 8 orders were placed each of size 200. Ordering cost is Rs.500 per order . Inventory carrying charges are 40 % of unit price. Cost per unit is Rs.400. Is the material manager Mr. A justified in his decision? What is the effect of his decision on company? **[10]**

Q4A. Determine the optimal sequence of the jobs that minimse the total elapsed time based on following information. The processing time on machines is given in hours **[10]**

	Jobs						
	A	B	C	D	E	F	G
Machine M1	3	8	7	4	9	8	7
Machine M2	4	3	2	5	1	4	3
Machine M3	6	7	5	11	5	6	12

Q4B. Two major parts P1 and P2 for product require processing through six machine centre. The technological sequence of the parts on six machines and manufacturing times on each machine are

Machine sequence	C	A	E	F	D	B
PART 1 Time (hrs):	2	3	4	5	6	1
Machine sequence	B	A	E	F	C	D
PART 2 Time (hrs):	3	2	5	3	2	3

What would be the optimal scheduling for processing two parts? Find also the Total Elapsed time. For each machine specify the job that should be done first Use graphical method. Attach the graph paper at the page of solution. **[10]**

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Q5A. A project schedule has following characteristics.

Activity	Time in weeks	activity	Time in weeks
1-2	4	5-6	4
1-3	1	5-7	8
2-4	1	6-8	1
3-4	1	7-8	2
3-5	6	8-10	5
4-9	5	9-10	7

Construct Network , compute E and L for each event. Find total Float. Find critical path. Comment on float. **[10]**

Q5B. A Manufacturer of biscuits is considering four types of gift packs containing three types of biscuits. Orange Cream [OC], Chocolate cream [CC], and Wafers [W]. Market research study conducted recently to assess the preferences of the consumers shows the following types of assortments to be in good demand.

Assortments	Contents	Selling price per kg in Rs.
A	Not less than 40 % of OC	20
	Not more than 20% of CC	
	Any quantity of W	
B	Not less than 20% of OC	25
	Not more than 40% of CC	
	Any quantity of W	
C	Not less than 50 % of OC	22
	Not more than 10% of CC	
	Any quantity of W	
D	No Restrictions	12

For the biscuits the manufacturing capacity and costs are given below.

Biscuits variety	Plant capacity [Kg/day]	Manufacturing costs Rs/kg
OC	200	8
CC	150	9
W	150	7

Formulate LPP to Maximise the profit assuming that there are no market restrictions. **[10]**

Q6A. A company buying scrap metal has two types of scrap metals available to it. The first type of scrap metal has 30% of metal A, 20% of Metal B and 50 % of Metal C by weight.
The second scrap has 40% of metal A , 10% of Metal B and 30% of Metal C. The company requires at least 240 kg of metal A, 100 kg of metal B and 200 kg of metal C. The price per kg of two scraps are Rs 120 and Rs 160 respectively. Determine the optimum quantities of of two types scraps to be purchased so that the requirements of three metals are satisfied at minimum costs.[Hint: Multiply both sides of inequalities by 10 to process the equations easily] Use graphical Method. **[10]**

page-3

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Manufacturing Planning & Control

Q6B. Construct the network diagram for the project comprising of activities B,C,E, F,G,H,I,J, L,M,N,P,Q such that the following precedence relationship are satisfied:

B<E,F; C,F, < G;C < L; E,G < H; H,L < I ; H<J; L <M; H,M <N; I,J <P;N <Q **[10]**

Q7A. What do you mean by Simulation? Why the simulation is needed? Explain the steps in Monte Carlo Simulation. State the salient features of Monte Carlo simulation. **[10]**

Q7B. What are salient features of JIT? What are the seven wastes? State the ways to reduce the seven wastes. **[10]**

Best of Luck!

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